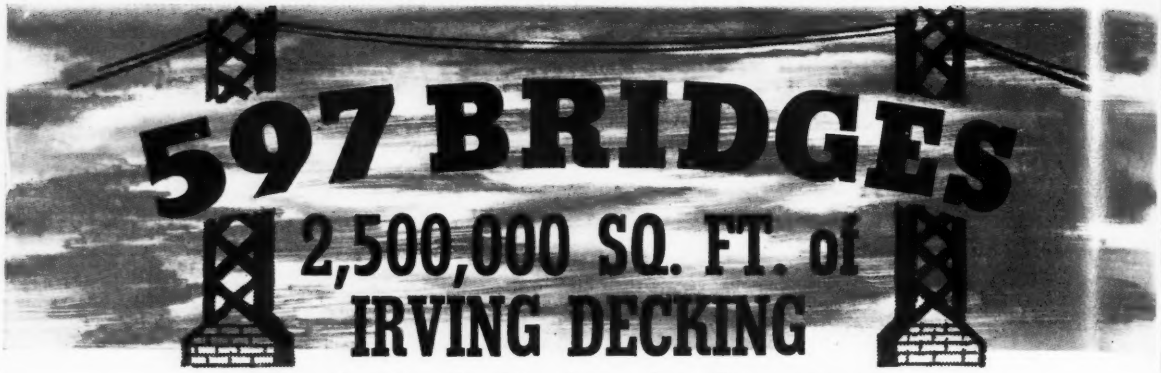
CIVIL ENGINEERING

APRIL 1955

THE MAGAZINE OF MODERN CONSTRUCTION

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

RARITAN RIVER BRIDGE – See article by C. H. Gronquist



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2,500,000 SQ. FT. of IRVING DECKING

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IRVING DECKING is 80% open, self-cleaning and self-draining, non-floating, not affected by wind pressure, lightweight, strong, safe, practically self-maintaining.

ONLY IRVING OFFERS you over 50 years of experience in quality production and sound application of open mesh metal flooring. Take advantage of it! Write for new engineering data catalog covering all fields of application.

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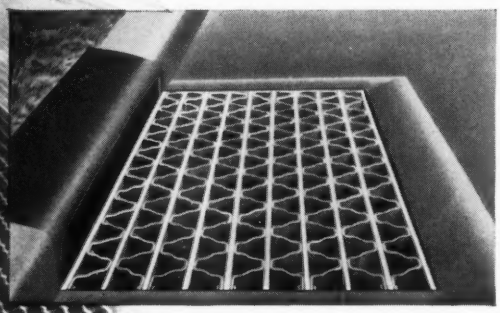

IRVING "DRYWAY" DRAINGRATES are simple to install, easy and inexpensive to maintain. These safe, clean and strong drain covers are available in Rectangular Mesh and Riveted Types.

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CIVIL ENGINEERING

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THE MAGAZINE OF ENGINEERED CONSTRUCTION

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• SOCIETY NEWS

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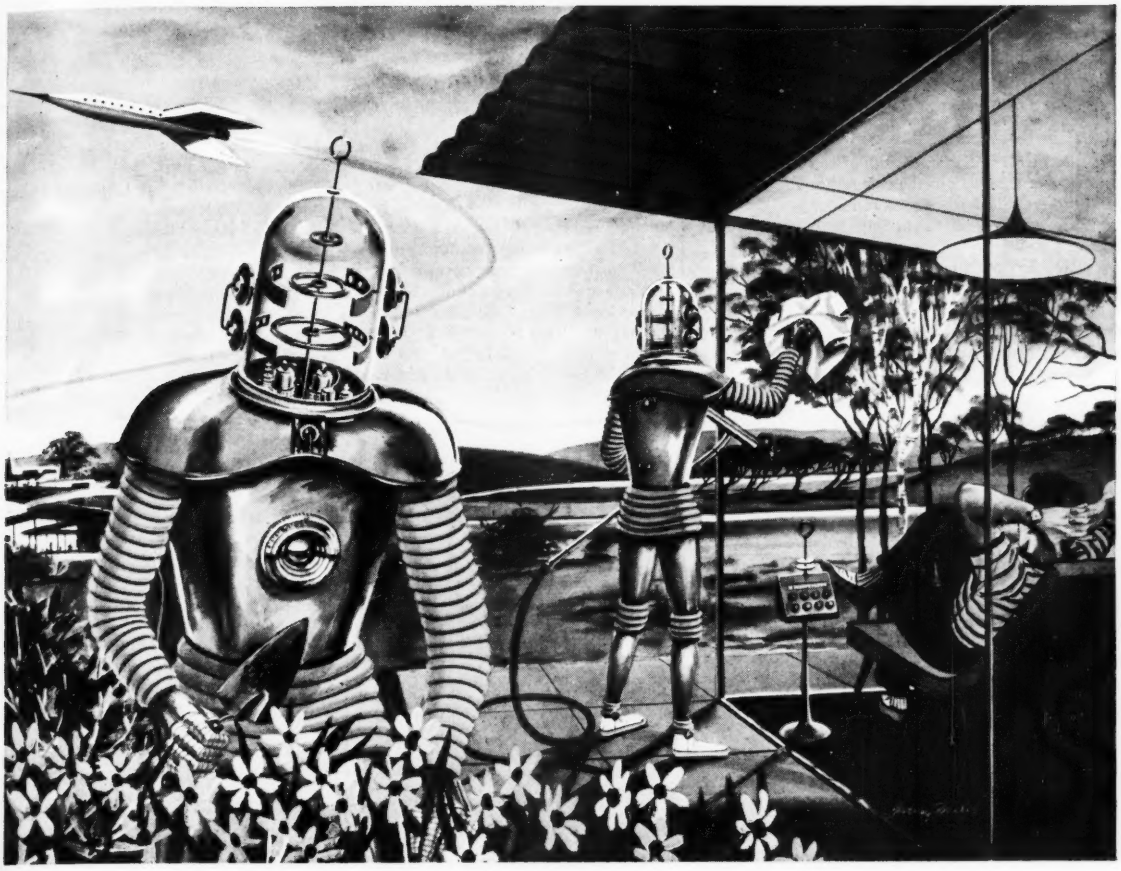

COMPETENT, BLOODLESS WORKERS . . . tireless, economical . . . electronically controlled and directed. These, science predicts, may be our "servants" of the future.

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The years ahead hold many surprises . . . wonderful new products and inventions to challenge the imagination. Then, as now, our water and gas will still be carried by the rugged, dependable cast iron pipe being laid today.

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NEWS OF ENGINEERS

Raymond H. Bailey has announced the formation of a new consulting engineering firm at 40 Whitaker St., Savannah, Ga. Mr. Bailey was recently assistant to the division engineer of the Seaboard Air Line Railway at Savannah. The firm, which will be called Ray Bailey and Associates, Consulting Engineers, will offer civil, structural, mechanical, electrical, chemical, sanitary, surveying and mapping engineering services.

Edward H. Kersting, of Buffalo, N.Y., has been promoted to vice-president of the Frazier-Davis Construction Company, a St. Louis heavy construction firm. Mr. Kersting started with the company 22 years ago, and in the past decade has managed projects in seven states and the Panama Canal Zone. He is currently project manager of two construction jobs in the Buffalo, N.Y., area including the vertical lift bridge over the Buffalo River.

Paul A. E. Flux has resigned after twenty years with the Connecticut State Highway Department to join the Crandall Engineering Company of Boston, Mass., where he will be vice-president and consultant. A retired captain in the Navy Civil Engineering Corps, he most recently held the position of senior design engineer.

Paul Flux

Fred S. Poorman, for the past year chief of the Technical Division in the office of the Assistant Secretary of Defense, has become deputy commissioner of buildings in the General Services Administration. Mr. Poorman, since 1940 connected with military and defense construction both as a civilian and officer in the Corps of Engineers, recently was deputy chief of the Engineering Division in the Washington office of the Chief of Engineers.

Benjamin S. Thayer has been elected director of United Engineers and Constructors, Inc., Philadelphia, Pa. Until recently Mr. Thayer was vice-president and construction manager.

C. Mortimer Throop and **Elliott Feiden** announced the formation of a partnership for the practice of consulting structural engineering. The firm, under the name, Throop & Feiden, will be located at 150 East 35th Street, New York City. Mr. Throop was formerly an associate in the firm, Seelye, Stevenson, Value & Knecht, and Mr. Feiden was structural engineer for the firm.

Richard O. Eaton, chief technical adviser of the Corps of Engineer's Beach Erosion Board, Washington, D.C., is one of three officials of the Board on a technical mission to Africa. The trip to Monrovia, Liberia, and Gambia will be for the purpose of inspecting rivers and harbors for navigation and advising on beach erosion and flood control. The group will advise the Liberian government through the Foreign Operations Administration.

Gilbert D. Fish, Stephen D. Teetor and **Harold S. Woodward** were admitted to partnership in the New York City firm, Seelye, Stevenson, Value & Knecht in January. They have been with the firm for many years.

John B. Carney, Jr., has become an associate engineer for the Benham Engineering Company, Oklahoma City, Okla. Until recently Mr. Carney was designer in the Bridge Department of the Oklahoma Highway Department.

Charles O. Clark has established a consulting practice in Tulsa, Okla. His prime concern is with water supply and utilization. For the past four years Mr. Clark has been on the staff of the chairman of the Arkansas-White-Red Basins Inter-Agency Committee as hydraulic engineer, and prior to that was engineering consultant to the Venezuelan Minister of Public Works.

Franklin K. Rader, professor of finance at Southern Methodist University, Dallas, Tex., will retire at the end of the year to become vice-president and director of the investment banking firm, Eppler, Guerin & Turner. He has recently been granted a leave of absence to serve the United Bankers Life Insurance Company as a member of the board and chairman of its finance committee.

Clayton O. Dohrenwend and **William R. Osgood,** have new positions at Rensselaer Polytechnic Institute. Dr. Dohrenwend, formerly professor and head of the Department of Mechanics, will be chairman of the Science Group of which he has been acting chairman since 1953. A graduate of RPI, he has been head of the department since 1949. Dr. Osgood, chairman of the department for the past four years, will assume duties as department head in September. A 1917 graduate of Harvard, he has been teaching since 1920.

Walter H. Wheeler, consulting engineer of South Minneapolis, Minn., has been named "Roster Engineer" for 1954–1955 by the Engineers Club of Minneapolis. Mr. Wheeler is a graduate of the University of Minnesota, class of 1906. In 1908 he and a partner opened an office in Denver, which later became the Jones-Wheeler-Cranner Engineering Company, to be succeeded by the Minneapolis firm of Walter H. Wheeler Consulting Engineer.

Thomas D. Shiels has been appointed district engineer of the Austin, Tex., office of the Portland Cement Association. Mr. Shiels joined the Association in 1925 as a field engineer in the Dallas district office. During the war he served in the Pacific Theater as commanding officer of an Army Aviation Engineering Construction Battalion.

(*Continued on page 24*)

News of Engineers

(*Continued from page 23*)

Edward F. Kawiak, who has been construction superintendent for the U. S. Navy's Third District at New York City, is now in charge of Naval construction at Reaction Motors at Rockaway and Bendix Corporation at Teterboro, both in New Jersey. Mr. Kawiak recently worked on the extension of the launchways for the *Nautilus* and on construction for the *Sea Wolf*.

Gordon F. A. Fletcher recently was appointed assistant vice-president in charge of the boring division of Raymond Concrete Pile Company. With the company since 1924, Mr. Fletcher has most recently been project manager in the New York office.

© *F. E. Falkenbury, Jr.*
G. F. Fletcher

Emil H. Praeger has been awarded the Gold Medal in Engineering by the Architectural League of New York City for his work for Madigan Hyland on the design of the unique hollow-box-type Pier 57 on the North River in New York City.

George E. P. Smith, professor of agricultural engineering at the University of Arizona, retired this January. A writer of numerous technical publications and annual water reports and the first to advocate and prepare a water code for Arizona, Dr. Smith joined the faculty of the university in 1900 as professor of civil engineering. Later he transferred to the agricultural engineering department which he headed until 1944. Since then he has been engaged in research at the agricultural experiment station.

David C. Hastings has been appointed superintendent of the Potomac Yard of the Richmond, Fredericksburg & Potomac Railroad effective February 16. Until recently Mr. Hastings was division engineer at Richmond, Va.

Edmund N. Peterson, consulting civil engineer to Ebasco Services, Inc., is presently project manager of Overseas Consultants, Inc., in Japan where he will work on the construction of the Kamishiiba Dam on Kyushu Island, one of the highest true arch dams in the world and the first of its type in Japan. Mr. Peterson, who has been connected with Ebasco since 1922, has had assignments all over the world.

Howard P. Hall, assistant professor of civil engineering at Northwestern University's Technological Institute, has been called to Europe to head a group of American technical experts investigating U.S. Air Force installations in the United Kingdom. The project will be concerned with foundation work, pavement and drainage.

Charles E. Sloan, since 1952 engineer of bridges and buildings for the Baltimore & Ohio Railway Company, retired on March 1 after more than forty-two years of service with the company. Entering the B & O engineering department in 1913, Mr. Sloan has held various positions with the company, including assistant engineer of bridges and engineer of bridges. He will be succeeded by **Abram Clark,** until recently assistant engineer of bridges and buildings. Mr. Clark has been with the B & O since 1923 and has been designing engineer and assistant engineer since 1952.

Lawrence E. Miller, a partner in the David Cleaver Construction Co. of Akron, Ohio, has been elected president of the Builders Exchange of Akron. Mr. Miller took office on January 12.

Dana Young, professor and chairman of the civil engineering department of Yale University, has been appointed dean of the School of Engineering. Dr. Young received a B.S. degree from Yale in 1926 and an M.S. in 1930. He has taught at the University of Connecticut, the University of Texas and the University of Minnesota, and has also been employed by various engineering companies including the Shell Petroleum Corporation and United Engineers & Constructors.

George A. Kennedy, until recently structural engineer with A. Epstein & Sons, Inc., Chicago, Ill., has opened a consulting structural engineering office at 20 E. Huron Street in Chicago. Previously Mr. Kennedy was associated with the firms of Skidmore, Owings & Merrill and Sargent & Lundy, Inc., both of Chicago.

Ross L. Mahon, who will retire May 1 from the S. Morgan Smith Co., York, Pa., for which he has been Pacific Coast representative at Carmel, Calif., will open an engineering sales consulting office in Carmel. Mr. Mahon's experience includes many years in the hydroelectric industry as vice-president and general manager of the Pelton Water Wheel Co. of San Francisco. He is a retired Colonel in the Army Engineer Reserve Corps.

John R. Hartley was honored by B-I-F Industries for twenty-five years of consecutive service at the organization's annual dinner in Providence on February 19. Mr. Hartley joined Builders-Providence in 1929 and is currently vice-president and manager of project sales in Providence.

George E. Spargo has been elected a trustee of the New York Savings Bank. He is general manager and secretary of the Triborough Bridge and Tunnel Authority in New York City.

Harold G. Garner and **Kenneth B. Lucas** took up new positions with the Portland Cement Association on February 21. Mr. Garner, recently district engineer in the Omaha, Nebr., office, will hold the same position in the Kansas City office and will direct Association activities throughout the state. He has been with the firm since 1940. Mr. Lucas, until recently special paving engineer, succeeds Mr. Garner in the Omaha office. Prior to joining the Association in 1947, Mr. Lucas was with the Kansas State Highway Commission and the Kansas Gas and Electric Company. He will direct activities for the Association in Nebraska.

William T. Wright, civil and structural engineer and member of the architectural-engineering firm of Kistner, Wright and Wright of Los Angeles, has been reappointed to the California Board of Registration for Civil and Professional Engineers by Governor Goodwin J. Knight. He was appointed in December 1953, to complete the unexpired term of the late Paul E. Jeffers, and now is to serve a four-year term.

(*Continued on page 28*)

663,936 lbs. flooring deadweight

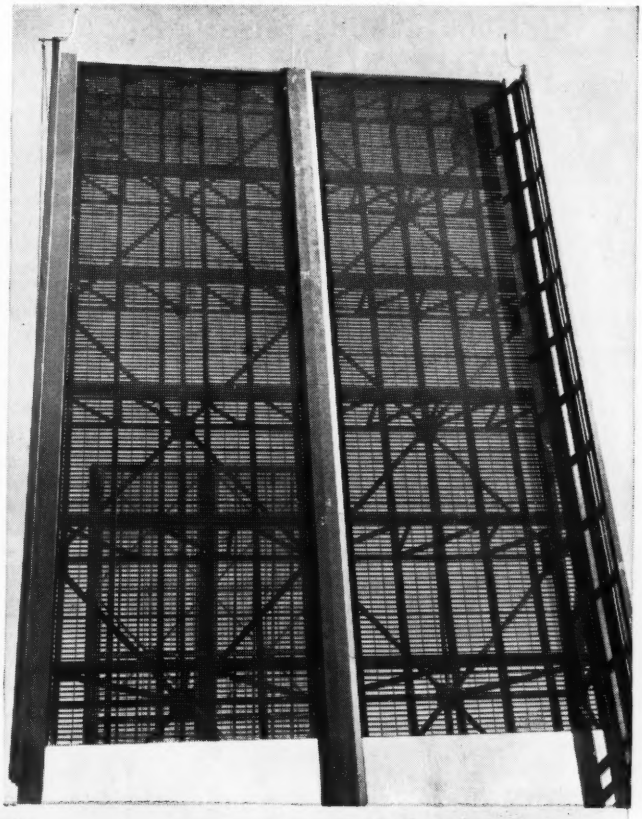
long, wide double-leaf bascule span

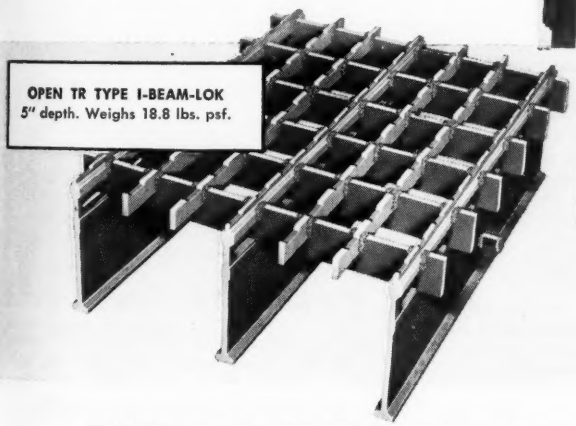
■ The 193'6" double-leaf bascule span on the four-lane Gilmore Street Bridge across the St. Johns River, at Jacksonville, Florida, provides another good example of the advantages of I-Beam-Lok lightweight steel flooring for structures of this type.

The total amount of USS I-Beam-Lok laid on the 55'11" roadway of the two bascule leaves is 10,677 sq. ft. of which 9,535 sq. ft. is the 5-inch open type flooring. The remaining 1,142 sq. ft. is the 3-inch concrete-filled type used in the part of the bascule leaves over the machinery.

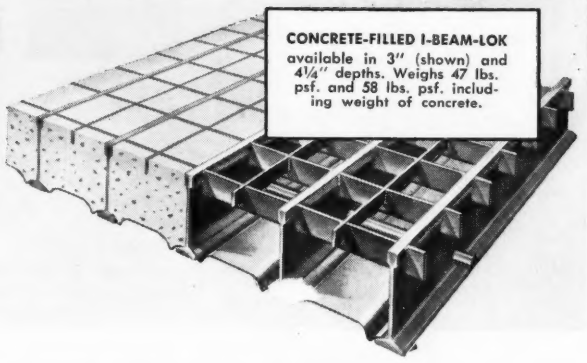
If conventional 7" concrete slab flooring (weighing 84 lbs. psf. as against 18.8 lbs. psf. for 5" open I-Beam-Lok and 47 lbs. psf. for 3" concrete filled I-Beam-Lok) had been used on this project, the floor of the long, wide double-leaf span would have had a deadweight of 896,868 pounds. *Four times greater than its present light 232,932 lbs. deadweight!* In addition, the heavier flooring would have increased the wind resistance of the span, and made necessary the installation of costlier, more powerful mechanical equipment to raise and lower the heavier bascule leaves of the span.

USS I-Beam-Lok is the modern floor for modern traffic. It combines lightweight and ensuing reduced costs with roadway rigidity, ease of erection, a smooth, hard surface and low maintenance costs. It is available in both open and concrete-filled types. Our engineers will be glad to discuss its possibilities with you. Just contact the sales office nearest you.





OPEN TR TYPE I-BEAM-LOK
5" depth. Weighs 18.8 lbs. psf.



CONCRETE-FILLED I-BEAM-LOK
available in 3" (shown) and 4¼" depths. Weighs 47 lbs. psf. and 58 lbs. psf. including weight of concrete.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS I-BEAM-LOK

USS

UNITED STATES STEEL

News of Engineers

(*Continued from page 25*)

Albert W. Wenthe, president of the Fruin-Colnon Contracting Company, St. Louis, Mo., was elected chairman of the board in January.

Philip M. Grennan, has become an associate in the office of Alfred Easton Poor, New York City architectural firm specializing in banks and airfields. A graduate in architecture of the University of Illinois, Mr. Grennan has been chief structural designer and project engineer for Ford, Bacon & Davis, New York City, for the past fourteen years. Earlier he was field engineer in Peru for the Cerro de Pasco Corporation.

P. M. Grennan

Mac Silvert has resigned as chief engineer with Ben C. Gerwick, Inc., San Francisco, to open his own office as a consulting construction engineer at 1845 Franklin Street, San Francisco 9.

Helmer A. Holmstrom, Lieutenant Colonel, U.S. Army, has been assigned as commanding officer of the Advance Section's 313th Engineer Construction Group in Verdun, France. This group forms a portion of the supply line from France's coastal ports to the American Forces in West Germany. Colonel Holmstrom's previous assignment was as executive officer of the Engineer Depot at Chinon, France.

©U.S. Army Photo

H. A. Holmstrom

Edward A. Miller, manager of the Building Panel Division of Detroit Steel Products, has been reelected secretary-treasurer of the Metal Roof Deck Technical Institute. He has held the office since 1945.

[*Editor's Note:* Through an error that is much regretted **Clinton N. Hernandez,** vice-president of the Turner Construction Company, New York, N.Y., was listed in the February issue as heading the Portland, Oreg., regional office of H. Zinder & Associates.]

RECENT BOOKS

Prestressed Concrete

A concise account of theoretical principles and practical design data for prestressed-concrete structures by Gustave Magnel, brought up to date to include developments since publication of the previous edition in 1950. About fifty pages of new material have been added, including descriptions of new methods of prestressing, a section on the breaking strength of statically-determinate beams, and additional examples of bridges and buildings. (McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y., 3rd edit., 1954. 345 pp., $8.00.)

Hölzerne Dach-und Hallenbauten

Wooden mill buildings and roof structures are treated in a highly practical manner. Part A covers the design of the fundamental structural elements; Part B gives details of the various types of roofs for residential and public buildings; Part C presents the engineering features of roof and shed structures, including stress analysis, erection methods, and detailed examples of designs for a wide range of specific purposes: industrial buildings, train sheds, airplane hangars, public halls and grandstands, etc. The authors are Anton Gattnar and Franz Trysna. (Wilhelm Ernst und Sohn, Berlin, 6th edit., 1954. 348 pp., D.M. 39.00.)

Annual Review of Nuclear Science

Volume 4—1954

The seventeen papers in the present volume are essentially surveys of the literature on recent developments, accompanied by extensive reference lists. Three of the papers are devoted to different aspects of nuclear particle detection, and there are papers on penetration of heavy charged particles in matter, radioactivity in geology and cosmology, and on various other topics. Author and subject indexes covering the entire volume are included. James G. Beckerley is the editor. (Annual Reviews, Inc., Stanford, Calif., 1954. $7.00.)

Basic Engineering Sciences

Problems, with solutions, selected from Part II of New York State Examinations for Engineer-in-Training and Professional Engineer, 1945-June 1954. They cover various aspects of hydraulics, thermodynamics, machine design, and electrical principles and equipment, with specific problems on stream flow, heat transfer, mechanical movements, generators and motors, etc. The author is William Glendinning. (5123 Bell Boulevard, Bayside, N. Y., 1954. 126 pp., $3.00.)

Big Dam Foolishness

The Problem of Modern Flood Control and Water Storage

The author, Elmer T. Peterson, a journalist who has traveled and read widely in his study of the problem of modern flood control and water storage, strongly advocates conservation practices such as upstream small dams and ponds, terracing, breaking-up of the plow pan, and the growing of cover crops. Highly critical of the big dam program, he discusses a number of water and flood control projects of both kinds, with comparisons of situations, costs, and overall effectiveness. Statements are quoted, but no bibliography is given. (The Devin-Adair Company, 23 East 26th Street, New York 10, N.Y., 1954. 224 pp., $3.75.)

Building Materials

Their Elasticity and Inelasticity

This book, edited by M. Reiner, considers the rheological behavior of materials in relation to problems of greater economy in the design of engineering structures. The opening general section is an exposition of the principles of rheology, physics, chemistry, and structural engineering necessary for an understanding of the text. The main part of the book covers a wide range of materials under four main categories: metals and wood; concrete; plaster and asphalt; soils and clay products; and minor materials such as paint, fiber boards, etc. References are listed after each chapter. (Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N.Y., 1954. 560 pp. $12.25.)

Climatic Atlas of the United States

Over a thousand maps and diagrams have been assembled in this volume by Stephen Sargent Visher in order to make readily available information previously found only in the records of the Weather Bureau and in various other sources. Data are presented on temperature, wind, sunshine, humidity, precipitation, consequences of climate and weather, climatic regions, and climatic changes. Trends are indicated so that the information may be useful in long-term planning for choice of architecture or heating and cooling facilities for residences and buildings. General interpretations are given in the first chapter and, occasionally, in the body of the book. (Harvard University Press, Cambridge, Mass., 1954. 403 pp., $9.00.)

Conveyors and Related Equipment

This comprehensive treatment by Wilbur G. Hudson of materials handling describes the application of a wide variety of equipment and analyzes the effectiveness of the several kinds. It provides a guide to the factors which must be considered when buying, operating, and maintaining conveyors and other devices. New material is included on dust explosion hazards, pneumatic conveying, hydraulic transportation of coal in pipelines, and a number of other subjects. (John Wiley & Sons, Inc., 330 West 42nd Street, New York 36, N.Y., third edition, 1954. 524 pp., $9.00.)

Der Dammbau

Grundlagen und Geotechnik der Stau- und Verkehrsdämme

A comprehensive treatise by Karl Keil on the construction and engineering geology of earth dams, highway and other embankments, and dikes. The theoretical principles of shape, materials, and organization of the work precede the practical treatment of construction methods, equipment, quality control, settlement problems, and the causes and avoidance of failures. A 500-item bibliography is included. (Springer-Verlag, Berlin, 2nd edit., 1954. 581 pp., D.M. 69.00.)

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 33 West 39th Street, New York 18, N.Y.

STEEL
PLATEWORK

by **PITTSBURGH DES MOINES**

Progress Report—from **FORT RANDALL**

Our multi-million-dollar project for the Corps of Engineers at Fort Randall Dam is concerned with steel. Here in South Dakota where the Missouri is being harnessed, we are building 8 steel surge tanks 59′ diameter by 100′ high; 8 steel penstocks 22′ diameter by 700′ long; an outlet pipe 22′ diameter by 700′ long, and related work. The picture shows the surge tanks, 95% complete, and in foreground the last 50-ton penstock can being lowered into Tunnel 10. The traveler crane is about to place a 30-ton can with ring girder into Tunnel 8. ● The craftsmanship is typically Pittsburgh-Des Moines. You can count on it for your forthcoming job—may we submit quotations?

PITTSBURGH·DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25),.....3470 Neville Island	DES MOINES (8),.....971 Tuttle Street
NEWARK (2),....251 Industrial Office Bldg.	DALLAS (1),.....1275 Praetorian Building
CHICAGO (3), 1274 First National Bank Bldg.	SEATTLE,.....578 Lane Street
LOS ANGELES (48),.....6399 Wilshire Blvd.	SANTA CLARA, CAL.,.....677 Alviso Road

do you know that

A monorail may one day connect downtown Houston with its suburbs? If a green light is given this project, now under study by a development and businessmen's group, a five-mile $2,500,000 test line will be built. Los Angeles' plan to build a 45.7-mile monorail is discussed in this issue (page 33) by former Vice-President George W. Burpee, whose firm has been making a feasibility study for the Los Angeles Metropolitan Transit Authority.

A $25 billion water and sewage program is urged by government agencies? To carry on the anti-pollution fight successfully expenditures of at least $25 billion will be necessary over the next ten years, according to a joint report of the Departments of Commerce and Labor.

The AIME has a new name and a new secretary? At its recent annual meeting in Chicago the American Institute of Mining and Metallurgical Engineers changed its name to the American Institute of Mining, Metallurgical and Petroleum Engineers. Its seal, consisting of crossed miners' hammers with the letters AIME spaced around the insignia, remains unchanged. Ernest Kirkendall is the new secretary, succeeding Edward H. Robie, who has been appointed secretary emeritus on a full-time basis.

Paying lower wages to inferior workmen does not save money? This is one of a number of timely thoughts expressed by President Glidden in his talk given at the opening session of the San Diego Convention and printed in this issue (page 38).

The Daniel W. Mead Prizes have been doubled in value? Young men of the Society and Student Chapters, this should be of interest to you! The cash value of the Mead Prizes for Junior Members and Students is now $100 and $50, respectively. Details on page 65.

Central Africa plans a huge power project? A 360-ft-high dam and a hydroelectric power development to cost $240,000,000 will be built on the Zambezi River between Northern and Southern Rhodesia, the Central African Parliament announces. With a minimum capacity of 740,000 kw, the project will assure urgently needed cheap power for the area.

EJC has two new member organizations? Engineers Joint Council has announced the election of the American Society of Refrigerating Engineers as a Constituent Society and the American Institute of Industrial Engineers as an Associate Society. News of EJC appears on pages 65 and 68.

Cement shortages will be over next year? This is the prediction of Vincent P. Ahearn, executive secretary of the National Ready Mixed Concrete Association. Concrete mills expect to ship 337 million barrels in 1956 and 407 million barrels in 1959, compared with shipments of 268 million barrels last year, Mr. Ahearn told a recent meeting of the Wisconsin Ready Mixed Concrete Association.

Construction continues to soar? New construction activity in February, at $2.6 billion, was 12 percent above last year's February high and set a new record for the month. Department of Commerce and Labor analyses on page 79.

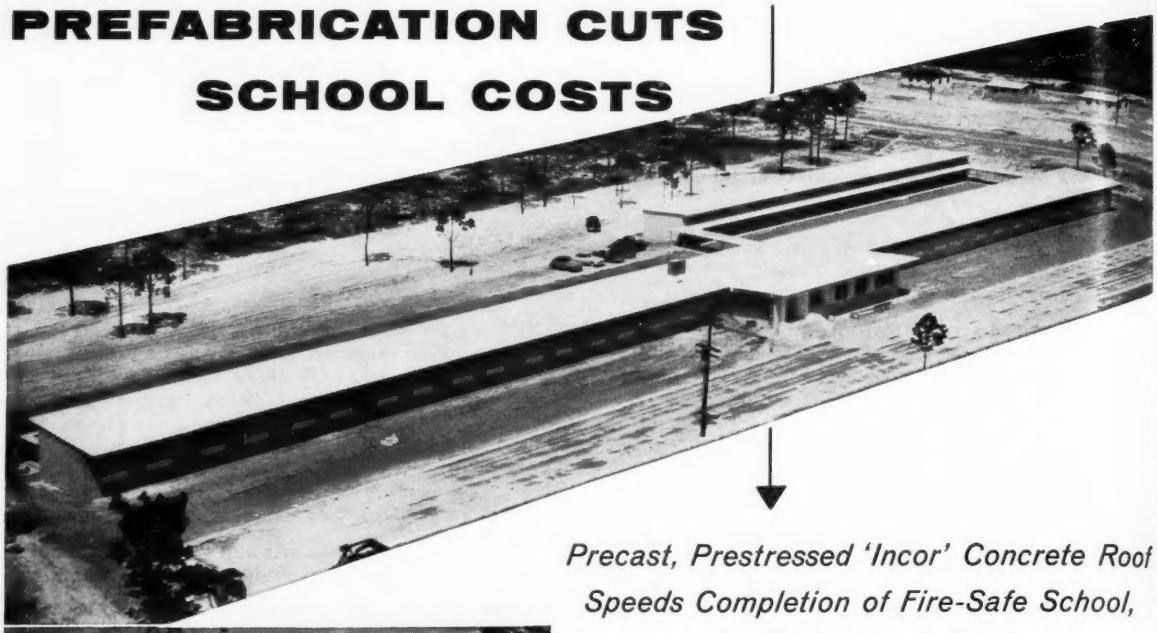
An ASCE publication on competitive bidding is available? The Society's stand on competitive bidding for professional services and court decisions relating to the subject are summarized in a new publication (designated M5) prepared by the Committee on Professional Practice. Members may obtain copies from Society headquarters at 25 cents each.

Sperm whale oil is being used to protect reservoirs in arid zones against evaporation? British scientists report that in Australia, New South Wales, and Africa, oil obtained from sperm whales is being used to form a monomolecular film on the surface of water holes and reservoirs to reduce evaporation by at least 30 percent.

There is much to see and do in St. Louis, locale of our next Convention? The full program of the Society's June Convention is scheduled for the next issue.

A great road system over 5,000 miles long was built by the Incas before the Spanish conquest? Longest of these arterial roads, which held the Inca Empire together, was a 2,211-mile coastal road, which had a standard width of 24 ft. The system included suspension bridges and floating bridges.

PREFABRICATION CUTS SCHOOL COSTS



Precast, Prestressed 'Incor' Concrete Roof Speeds Completion of Fire-Safe School, At Big Saving in Cost

● With enough children being born every fifteen minutes to fill a classroom, and a million pupils in sub-standard quarters, the nation faces a race against time in solving the school problem.

Fort Lauderdale comes up with a sound solution. Dillard Elementary School, with 21 classrooms and about 25,000 sq. ft. of floor space, was completed 18 weeks ahead of schedule. Cost, $273,000.—$38,500. under the appropriation.

Built of fire-safe concrete, speed and economy pivoted on the roof system, consisting of 32,000 sq. ft. of double-tee, precast, prestressed roof slabs, 221 in all. Each slab is 34½ ft. x 4 ft., with 23 ft. clear span and 6 ft. cantilever on one side, 4 ft. on the other.

With ten hours' steam-curing, dependable 'Incor'* high early strength produced 4000 psi in 20 hours for pretensioning and stripping immediately thereafter . . . 11,000 sq. ft. of roof slabs placed in an eight-hour day . . . electric conduits and outlet boxes precast in the slabs.

Double-tee design gives pleasing beam effect. Quality concrete, with smooth exposed roof and ceiling surfaces, only required painting to finish.

Another example of attractive, fire-safe construction, faster and at less cost, thanks to the two I's —Ingenious design and 'Incor' performance.

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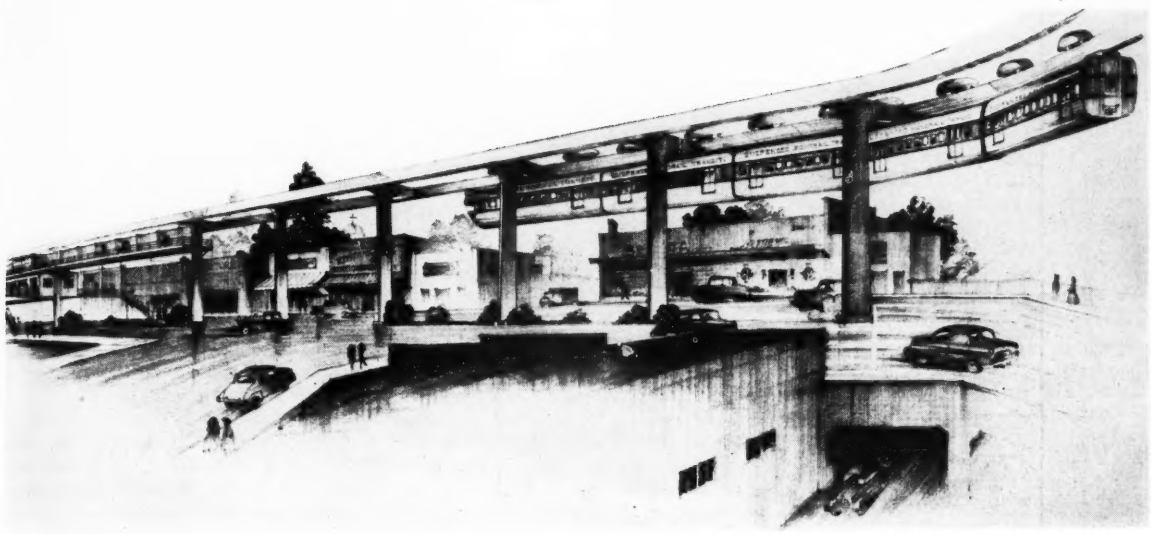


A MONORAIL SYSTEM FOR LOS ANGELES

Study shows that rapid transit line 45.7 miles long could cut commuting time in half

GEORGE W. BURPEE, M. ASCE
Coverdale & Colpitts, New York, N.Y.

In monorail system, cars are suspended from single rail carried on girder supported by T-bents. Bents are spaced about 60 ft apart, and columns are located in center of street, so as to cause minimum interference with surface traffic.

Los Angeles is one of the most interesting cities in the United States from the point of view of passenger transportation. Of the great cities of the world, it is unique in that the greater part of its growth has occurred since the automobile came into common use. Hence the city, except the central business district, was designed for the automobile and grew up dependent on it. Consequently it is a city of relatively low population density with a very high standard of living, where most of the residents prefer to own their own homes rather than to live in apartments. Los Angeles has the

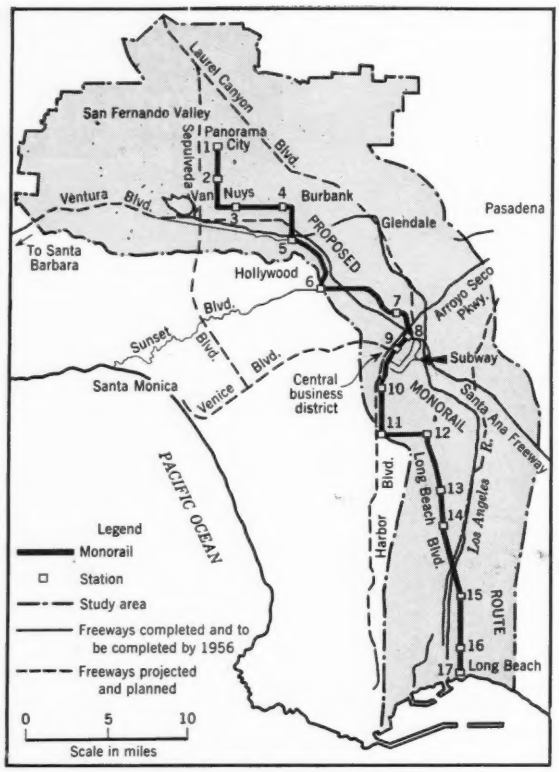


FIG. 1. Study area for monorail system is band about 4 miles wide on each side of Los Angeles River from San Fernando Valley to Long Beach. Stations are planned at numbered points: (1) Panorama, (2) Van Nuys, (3) Chandler and Woodman, (4) North Hollywood, (5) Ventura, (6) Hollywood, (7) Glendale Boulevard, (8) Civic Center, (9) Hill and Seventh Street, (10) Broadway Place, (11) Main and Florence, (12) Florence and Pacific, (13) Imperial Highway, (14) Compton, (15) San Antonio Drive, (16) Pacific Coast, (17) Long Beach.

highest ratio of automobile ownership to population of any city in the world. Los Angeles has never had an off-surface rapid-transit system similar to those of Boston, New York, Philadelphia, and Chicago.

In 1920, which we may take as the time when automobiles were beginning to come into common use, the population of Los Angeles County was only 936,000. At the beginning of 1955 it was estimated at 5,241,000. It is projected as 5,500,000 in 1960 and 7,500,000 in 1980. Present growth indicates that the projection for 1960 is on the low side. Of course, most of the new population will occur in peripheral areas. The study area for the monorail contains more than half the population of Los Angeles County, and has an average density of 7,500 per sq mile.

Use of individual automobiles for passenger transportation was encouraged by the construction of an extensive boulevard system, now being superseded by freeways. The combination of boulevards and freeways has had a profound influence on the transportation habits of the people.

Existing mass transit facilities

Mass transit facilities available today in the Los Angeles area are provided principally by the Los Angeles Transit Lines and the Metropolitan Coach Lines—the latter the successor to the passenger transportation business of the Pacific Electric Railway. The former operates an extensive system of electric trolley and bus lines, carrying 439,812,000 passengers in 1947, its peak year, and only 256,947,000 in 1952. The latter, the Pacific Electric Railway, carried 177,823,000 passengers in 1945, the peak year, and only 92,475,000 in 1952. On both systems, remaining trolley lines are being rapidly replaced by busses.

Of all persons entering the central business district only 30 percent do so by mass transit. The principal means of passenger transportation is the individual automobile and any form of mass rapid transit that is to be a success must take this fact into consideration and be so designed as to offer advantages in comfort, safety, reliability, and particularly in overall speed. Speed in Los Angeles does not mean the 20 to 24 miles an hour that is typical of rapid transit in the four cities mentioned in the East, nor does it mean an overload of 100 percent of seating capacity, which is common during the rush period in most of the cities of the East.

Survey organized

Against this background I was interested when my firm was asked by the Los Angeles Metropolitan Transit Authority in 1953 to assist it in carrying out the mandate of the California State Legislature by making a study of a monorail system to extend from the San Fernando Valley to Long Beach within a zone four miles wide on each side of the Los Angeles River on the coastal plain. The study was limited to monorail by legislative enactment.

To assist in this study, Coverdale & Colpitts engaged Ruscardon Engineers of Los Angeles and Gibbs & Hill, Inc. of New York. Ruscardon Engineers were to assemble and correlate the economic data of the Los Angeles metropolitan area and secure origin and destination information. Donald McCord Baker, M. ASCE, a partner in Ruscardon Engineers, undertook this part of the study. Gibbs & Hill, Inc., were engaged to design the monorail system and estimate its construction and operation cost, with E. H. Anson, M. ASCE, Vice President, in responsible charge of the studies. The results of all these studies were reported to the Los Angeles Metropolitan Transit Authority in January 1954.

By the Legislative Act the route was to extend from some point in the San Fernando Valley to Long Beach (Fig. 1). The northern terminus was chosen as Panorama. The structure is elevated for its entire length except for the two miles in Hill Street, where it is in subway because of traffic congestion and the narrowness of the sidewalks.

The system has been designed as an interurban system, not as an urban distribution system, and to obtain a desirable over-all speed, the stations have been located an average of 2.8 miles apart. It is contemplated that the existing bus and trolley lines will serve as collecting and distributing feeders.

With high rates of acceleration and deceleration, a maximum speed between stations of 60 miles per hour can be reached, resulting in an average speed of 40 miles per hour. The distance from Panorama to Seventh and Hill Street is 22.6 miles and the estimated running time, including station stops of 20 sec

each, is 34 min. From Seventh and Hill Street to the southern terminus the distance is 23.1 miles and the running time, including station stops, 33 min. The entire length of the line is 45.7 miles and the estimated running time for a through trip is 67 min.

Thus the desirable characteristic of speed with safety and comfort is attained. At each station, except the two in the central business district, which are underground, and the one at the southern terminus, large parking lots will be maintained, providing total parking space for 4,500 cars at a nominal fee for the day. The availability of such parking space has proved useful in other localities as a means of widening the area served by interurban rapid transit.

Times of transit between the center of the business district and Van Nuys by means of various facilities are estimated as follows:

Rail rapid transit	30 min
Private automobile	53½ min
Buses, using freeways	68 min

Between North Hollywood and the center of Los Angeles, the estimated comparative times are:

Rail rapid transit	21 min
Private automobile	37½ min
Buses, using freeways	45 min

Corresponding times of transit between the center of the Los Angeles business district and Long Beach are:

Rail rapid transit	33 min
Private automobile (assuming completion of freeways)	53 min
Buses (assuming completion of freeways)	58 min

These comparisons speak for themselves.

Monorail system described

In the monorail system that has been studied, the cars are suspended from a single rail carried on a girder supported at intervals of about 60 ft by transverse bents generally in the form of a "T" with the columns centrally located in the street so as to interfere as little as possible with street traffic. The stations on the overhead parts of the line are generally over the streets with mezzanines below the train platforms. Access is by stairways or escalators located either on sidewalks or on private property.

It is contemplated that trains will be composed of six cars each, the cars to be of modern design, all-metal construction, seating 67 passengers each. Each car is suspended from two trucks and each of the two trucks is provided with two double-flange wheels. The center of gravity of the car is directly below the rail. Side clearances permit sway of the car body in passing around curves or by wind pressure. The supporting structure is so designed as to provide 16 ft clear between the bottom of the cars and the surface of the street. This brings the girders at about 26 ft above the road surface. Each car truck frame will carry two 100-hp, 3-phase, a-c squirrel-cage-type induction motors propelling the cars through hydraulic torque converters. No propulsion power circuits are located in the car bodies. With this arrangement the induction motor comes up to speed very rapidly, and the need for converters to change a-c to d-c current is eliminated.

Three-phase 60-cycle a-c current at 2,300 v is delivered to the cars by a dual-wire contact system, and the running rail has the three-phase conductors. Energy is supplied from simple stationary transformer-unit substations located in parking lots adjacent to passenger stations. Each substation is fed over two independent supply lines by the utility serving the area where the substation is located.

Trains are turned by running around a loop track. Such turnback loops would be provided at each end of the line, at North Hollywood and Glendale in the northern zone, and near Washington Boulevard and Compton in the southern zone, so that service could be adjusted to meet the demand. The signal system is planned for a maximum of 40 trains per hour in one direction on a single track or a train interval of 1½ min. This signal system, the most modern yet designed and the most nearly foolproof, includes cab-signal indication so that the motorman is given notice of signal aspects ahead, thus avoiding any possible confusion with background colored lights. It is equipped to stop trains automatically should a motorman inadvertently fail to obey a stop signal.

It is planned to locate the principal repair shops about 2½ miles west of the North Hollywood Station. At this location there will also be a storage yard and inspection facilities. For the southern division the storage yard, inspection facilities, and loop will be about two miles south of the Compton Station. For heavy repairs, cars will be taken to the shops west of North Hollywood.

There is no feature of this type of installation that has not already been proved in practice. The assembly, however, has not yet been proven, and it has been recommended that trials be conducted on models of reasonable size in order to test particularly the operation of the motors and the signal system, as well as the sway of cars on curves and the ability to hold them at station platforms magnetically.

Sources of traffic for the monorail project are basically persons now moving by private automobile and the long-haul passengers of present transit systems. Certain information made available from studies by the Pacific Electric Railway Company and the Los Angeles Transit Lines, indicates that about 70 percent of all traffic in the study area using mass transit facilities enters the central business district, including the Civic Center, and that of the total number of people moving in the area north of Los Angeles, about 43 percent come from the Hollywood section and about 22 percent from the vicinity of Glendale Boulevard Station.

South of the central business district it appears that 65 percent of the total passengers moving along the Pacific Electric Lines have origins or destinations in the central business district, and that 33 percent of the total traffic moves from that district to the Lynnwood-Compton area. Taking all these figures together, the indication is that 60 to 70 percent of potential transit riders would enter the central business district, including the Civic Center. An analysis of riders of the Los Angeles Transit Lines by lines indicates that only about 20 percent of the total passengers would be potential to the monorail system.

As for private automobiles, an analysis of available data showed that about 150,000 vehicles a day enter and leave the central business district from the monorail study area northwest of the Central Business District. This compares with a total traffic on the Hollywood Freeway averaging 120,000 vehicles a day in 1953. To the south, about 198,000 vehicles a day enter and leave the Central Business District.

One of the interesting conclusions from this study of vehicles entering the central business district is that for some years the number of persons entering in the morning and leaving at night has been fairly constant at between 600,000 and 700,000 a day. We estimate that this number is more likely to decrease than to increase in the next 20 years, and we assume that it will not be over 600,000 by 1980. This, of course, is a result of decentralization. Nonetheless, 600,000 people a day represents roughly 12 percent of the total population of the metropolitan district, and if a mass rapid-transit system were to carry half of this number it would have a substantial load. An interesting phenomenon in this study is the low average number of persons per automobile—1.45 including the driver.

The study indicates a potential of 785,000 persons within the study area for an average weekday in 1953, of which about 15 percent are at present using mass transit facilities and 85 percent individual automobiles.

Mr. Baker of Ruscardon Engineers made an origin and destination survey

of employed persons by obtaining, through the cooperation of numerous employers of large groups within the study area, the names and addresses of employees tabulated by postal zones. This method of obtaining the origin and destination of almost 400,000 people proved most economical, and showed that of this total about 153,000 were potential users of the monorail system.

In estimating that part of the total rides that the monorail would expect to receive, consideration was given to the relative time, distance, and cost of use as compared with alternate means of travel, such as first, competing bus or rail lines, and second, private automobiles. Experience in estimating highway traffic indicates that time saving is a relatively safe measure of the extent to which passengers can be diverted from one facility to another. Convenience, reliability, safety are all influential but none of them is measurable, whereas the saving in time is a measurable factor. The monorail shows such substantial savings in time, even as compared with automobiles, and at a cost not far greater than existing mass transit facilities, that it appears capable of diverting a substantial volume of business from automobiles to itself.

From examination of all the above data, the average weekday traffic potential to the monorail was estimated at something over 1,100,000, of which 230,000 a day was estimated to be diverted to the monorail. The annual equivalent is 79,000,000.

In peak hours on the freeways, traffic is congested and speed is adversely affected. Average speeds in congested sections, for two hours in the morning and two hours in the evening, are only about half the off-peak average.

A zone system of fare collection has been proposed. Three zones would be established—the northern between Panorama and Hollywood; the central, to include Glendale Boulevard, Civic Center and Seventh and Hill Street; and the southern, from Broadway Place to Long Beach. Turnstiles and barriers would ensure fare collection with a minimum of attendants. Passengers boarding at stations north of Glendale Boulevard would deposit a quarter on entering but nothing on leaving southbound within this zone. In the central zone each passenger would deposit 10 cents on entering and 10 cents on leaving. In the southern zone each passenger would deposit a quarter on entering but nothing on leaving northbound within the zone. In the northern zone northbound passengers would pay only on leaving and in the southern zone southbound passengers would pay only on leaving. Thus a passenger from Panorama to Hollywood would pay 25 cents; to Civic Center (or any of the three stations in the central zone) 35 cents; and to any station in the southern zone 50 cents. The fare for all passengers on the central zone would be 20 cents, and the fares for passengers boarding in the southern zone would follow the same pattern in reverse of that described for the northern zone.

Estimated costs

The estimated cost of construction is given in Table I. The bond issue to cover this cost, and working capital, administration and legal expenses during construction, interest during construction, and cost of financing is for $165,207,000. This does not include claims of abutting property owners, which may or may not arise because of the elevated structure in the street.

Costs of maintaining and operating the line were estimated at $8,771,000 before taxes, on the basis of a detailed budget and also from a study of existing rapid transit operations. Taxes, computed on the basis used in Los Angeles, amount to $4,988,000. This unusual amount arises from the ad valorem tax of $6\frac{1}{2}$ percent on half the value of the property. The high cost results in a very high tax rate. Estimated annual charges necessary to service the debt, allowing 5 percent for interest and 3 percent for retirement of debt, are $13,216,000. The total annual expense and charge is $26,975,000.

The foregoing estimate of maintenance and operating expenses before taxes is equivalent to 33.8 cents per car mile. This low cost results from the extremely high overall speed, the relatively few stations, and the low manpower requirements for train operation —two men per six-car train.

Based on all the available statistics and the origin and destination study, the passenger traffic was as already stated, estimated at 79,000,000. Taking into account the average trip, the average fare worked out at about 30 cents per passenger, equivalent to an annual passenger revenue of $23,500,000. Estimated revenues would be increased by about 1 percent of revenue from passengers by income from advertising privileges, car cards, station posters, and other revenue amounting to $235,000. The picture would then be as follows:

Gross revenues	$23,735,000
Operating expenses	− 8,771,000
Available for depreciation, taxes, debt service	14,964,000
Interest and amortization	−13,216,000
Remaining before taxes	1,748,000
Taxes	4,988,000
Annual deficit	3,240,000

Of the $13,216,000 a year required for debt service, the interest is $8,260,000, so that, before taxes, interest is earned about 1.8 times.

To the extent that some compromise on taxes may be possible, this deficit would be reduced. A shortening of the line to serve the area between North Hollywood and Compton only, would improve the economy. The shorter line, if tax relief were granted, might become self-supporting.

As these taxes are new ones, not now collected, it is conceivable that the municipalities might exchange them for relief from congestion on streets and freeways and for the improved service provided for their residents.

Conclusions from this study are that a monorail system or a rail system of any type capable of transporting passengers at a correspondingly high speed, can be of great service in the area, and that, under certain circumstances, such a line might even become self-supporting, which in itself is a novelty in a rapid-transit system. Since the monorail is designed as an interurban line and not as a distribution line, it would be competitive only with the long-haul lines of existing facilities. It is logical to expect that through the increased use of public transportation which the monorail's speed would engender, the existing lines would eventually gain traffic rather than lose it.

(This article is based on Mr. Burpee's paper presented at the San Diego Convention, before the City Planning Division session presided over by Huber E. Smutz, member of the Division's Executive Committee.)

TABLE I. Estimated cost of constructing monorail system

Structure, including steel, foundations, and stations (except two in subway section)		$ 61,104,175
Equipment, including trolleys, rail, signals and intercommunication system, substations and power distribution, complete except cars		13,830,249
Subway structure, including two stations (under Hill Street)		21,800,000
Repair shops and storage yards, completely equipped		6,081,011
Land acquisition, including parking lots		3,261,030
Cars for initial operation:		
131 cars at $80,000	$10,480,000	
Equipment for inspection and maintenance	110,000	10,590,000
Miscellaneous including model testing, procurement of equipment and material, field surveys, engineering insurance during construction, and training personnel		10,500,000
Contingencies		10,000,000
Total		$137,166,465

Lagoon discharge structures of corrugated steel sheeting

MAX CARDIFF, Design Engineer, A. M. Kinney, Inc., Cincinnati, Ohio

Faced with the problem of designing discharge structures for three lime-sludge lagoons at the Atomic Energy Commission's gaseous diffusion plant in Pike County, Ohio, the engineers selected a unique application of interlocking steel sheeting.

The lagoons, each covering approximately four acres, had been designed to take waste lime sludge from the project's water treatment plant for the first few years of plant operation. The problem was to provide a suitable low-cost means of removing the surface fluid from the lagoons after settling of the solids, and to provide a method of protecting the lagoon dikes from overtopping as a result of large sludge and storm inflows.

To solve this problem, a structure running through the dikes of each lagoon was designed with the following features:

1. An upstream channel constructed with walls of corrugated steel sheeting driven to rock and interbraced with creosoted timbers.
2. A discharge pipe under the downstream side of the dike embankment.
3. Steel sheeting cutoff walls driven to rock at the middle of the dike.
4. Timber stop-logs located at the upstream end of the discharge pipe.

At the center of the dike, each structure has a height of approximately 11 ft above ground level, with the steel sheeting extending to rock approximately 3 ft below ground level. The width of the channel is 2 ft 6 in., and the discharge pipe is 24 in. in diameter.

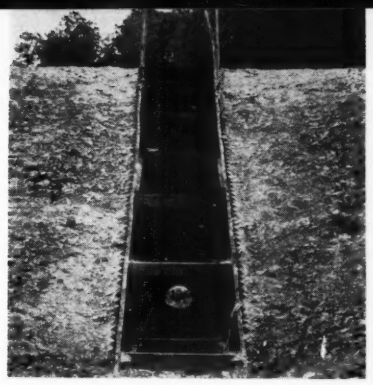
Two major advantages were obtained by using the steel sheeting in place of the conventional reinforced concrete walls—lower initial cost and salvage value. The only concrete used was for a small, plain concrete pad at the entrance to the discharge pipe. All other materials could be salvaged for reuse in the planned future lagoon construction.

Additional advantages were ease of construction and reduced weight of construction materials. The simplicity of construction and operation of the structures were features that could not be found in any of the alternate arrangements studied by the engineers.

The construction forces were given the option of either driving the sheeting after completion of the dikes, or placing the sheeting prior to the embankment. They elected to install the sheeting, timbers, and pipe before placing the embankment. The bracing timbers and stop-log guides were bolted to the corrugated sheeting. The connection of the discharge pipe to the cutoff-wall sheeting was made by cutting the sheeting after its installation, and welding the discharge pipe to the sheeting at the cut opening.

Each structure will be manually operated by removing stop-logs at any desired lagoon level (Fig. 1), permitting the flow of surface water through the discharge pipe into the creek channel which is adjacent to the dikes. It is anticipated that outlet operation will be required at two- to three-month intervals, depending on the weather.

The engineers for the lime-sludge disposal system were A. M. Kinney, Inc., consulting engineers, Cincinnati, Ohio. Construction was performed by Peter Kiewit Sons' Company. Armco Drainage & Metal Products supplied their "interlocking steel sheeting" for the channel and cutoff walls, and their coated corrugated metal pipe for the discharge pipe.



Inlet for discharge structure through lagoon embankment is seen completed but without stop-logs (top), and under construction (directly above). Interbraced sheeting of inlet extends from cutoff walls. View of downstream side (below) shows corrugated discharge pipe.

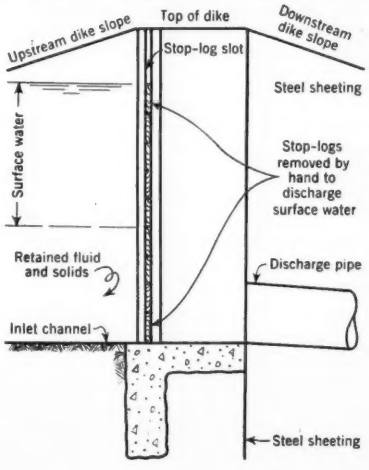


FIG. 1. Section through outlet structure indicates stop-log location and operation. Steel sheeting was driven to rock.

WILLIAM ROY GLIDDEN, President ASCE

Assistant Chief Engineer, Virginia Department of Highways, Richmond, Va.

Employment conditions and leadership

In contrast with the members of other learned professions, most engineers are employees, working for definite stipends with prescribed hours of work. More than 90 percent of the membership of our Society is in this category, and of these about half are civil servants. Since practically all engineers of the employer group are members of the Society, it may be deduced that nearly all non-members in the profession are employees.

Economic advantages enjoyed by a profession whose members are individual entrepreneurs, as for example the medical profession, because of its professional organizations, are obtained by procedures and practices not open or applicable to us.

Wages and occupations

Economic law recognizes no fundamental differences in employment conditions between manual and intellectual labor. During the first quarter of the nineteenth century a group of economists developed the theory that "the natural price of labor is that price which is necessary to enable the laborers, one with another, to subsist and to perpetuate their race, without either increase or diminution." This doctrine in its most rigid form is known as the "iron law of wages." The facts of today do not agree in a literal sense with this theory, and in a more elastic form the "minimum of subsistence" shades into what may be termed more accurately the "standard of living." Every advance in the standard of living is a definite gain in the economic progress of those who sell their labor and fixes a new datum for still further progress. Most of the advance since the beginning of the industrial revolution may be attributed to increased production and collective bargaining. But the proportionate influence of these two factors is admittedly debatable.

The supply of labor in any occupation is determined fundamentally by the standard of living obtainable, and any encroachment is met with solid resistance. It provides an element of strength in collective bargaining. It must not be overlooked that good living enhances productive efficiency and thereby increases earning capacity.

Laborers are attracted to different occupations by considerations other than wages. Salary scales in different employments may be greatly disproportionate to the differences in the required training or ability. Adam Smith lists five circumstances which "make up for a small pecuniary gain in some employments and counterbalance a great one in others." They are:

"1. The agreeableness or disagreeableness of the employments themselves;

"2. The easiness and cheapness, or the difficulty and expense, of learning them;

"3. The constancy or inconstancy of employment in them;

"4. The small or great trust which must be reposed in those who exercise them; and

"5. The probability or improbability of success in them."

Commenting on this subject, Richard T. Ely points out that "These circumstances need explanation in two particulars: First, the agreeableness or disagreeableness of an employment is very often a matter of social standing. Many men are doing clerical work to whom some kind of physical exertion would be both more pleasant and more profitable, but who dislike to be classed among the 'manual laborers.' So-called 'professional pursuits' attract many men to whom more lucrative opportunities, requiring less special preparation, are open in other employments. [Is he talking about us?] In the second place, the significance of these cirumstances is affected by the fact that the most poorly paid (because the least efficient) laborers are found in the most disagreeable and the most uncertain employments."

Declaration of the Three Freedoms

The employer is at an advantage when fixing the salary of a prospective employee. He has a better knowledge of the "market," the value of the new services to the organization and the availability of applicants. Knowing the market, he can closely estimate the minimum acceptable salary. The applicant usually does not know how much the employer will pay or his need for the services, and moreover because of his limited ability to hold out for higher remuneration he may be placed in the position of making a forced sale.

When the services required do not involve outstanding skill, as in subprofessional work, the employer is indifferent to personalities, but the position open may be of vital importance to the applicant. Thus salaries will be fixed in the lower part of the range between the minimum the applicant will accept and the maximum that can be obtained. Where there are a number of workers in groups performing similar functions, many of their disadvantages may be eliminated if they bargain, not as individuals, but as collective units. The employer cannot be indifferent to the potential effect of group action.

When any group in our social order secures a specific advantage in compensation (unless a corresponding increase in productivity results), the gains are at the expense of the general public. Now that a large segment of those gainfully employed in this country enjoy the apparent advantages of collective bargaining, it seems not unreasonable to assume that the system will be extended and will tend toward universal application. If this system becomes universal,

organized labor will no longer be able to play off one political party against the other. Then, at long last, will a dominant political party have the courage to initiate the legislation so sorely needed to correct the abuses of power now so prevalent in the labor unions.

No other professional engineering society has been as alert as ASCE to the problem of collective bargaining or has expended so much constructive effort in the guidance and protection of its members.

The effect of labor unions on professional employees came into sharp focus shortly after the passage of the Wagner Act in 1935. In 1937 ASCE established a Committee on Unionization which later became the Committee on Employment Conditions. After extensive work involving much trial and error, and in the face of ridicule and scorn, the committee in the propitious year of 1946 recommended to the ASCE Board of Direction the now famous three-point policy statement which was formally adopted by the Board. I like to think of this statement as a Declaration of the Three Freedoms for professional employees. These freedoms are:

1. **Freedom to form and administer independent bargaining units**
2. **Freedom from association with a bargaining unit which includes nonprofessionals**
3. **Freedom to employment unconditioned by membership in a bargaining unit**

This ASCE policy was endorsed by Engineers Joint Council which, together with the American Society for Engineering Education and the National Society of Professional Engineers, induced the 80th Congress to include professional employee provisions in the "Labor Management Relations Act, 1947," commonly known as the "Taft-Hartley Act."

For a comprehensive review of Society attitude and its potential for effective service in these matters, members are referred to the memorandum on "Engineers, Unionization and the Tax Status of ASCE," prepared for the information of the Board of Direction and other members of the Society by W. N. Carey, Executive Secretary, and E. L. Chandler, Assistant Secretary. You are also referred to an informative series of articles appearing in CIVIL ENGINEERING for May, July, September, and November 1954. I especially commend the thoughtful report by our Committee on Employment Conditions, summarized in the May issue.

You will learn that ASCE has gone as far as it can go in assisting in the establishment of collective bargaining units for professionals under the existing legal framework. You will learn that, on the basis of a recent questionnaire, 61 percent of ASCE members are opposed to collective bargaining but that nearly one half of our Junior Members are not opposed. Should we consider endorsing collective bargaining just for our preprofessional members? To me it is obvious that collective bargaining is not for mature professionals.

Obviously no professional society can blossom out as a labor union for the simple and completely logical reason that its membership includes both employers and employees. But we should continue to give and to augment sympathetic guidance to the younger members of our profession, and not frown too severely when by independent action they seek to improve their economic status by any means available to them compatible with professional dignity.

In the Declaration of the Three Freedoms there is implicit approval by the Board of Direction of the principle of collective bargaining for and by engineers, but the emphasis is on a dissociation from, and a counter-offensive to, the ordinary, predatory type of labor organization. Those who are content with mediocrity will stay in whatever unions may be established, but it is certain that no union cards will be found in the pockets of the leaders of the profession or of those on the way up.

Dilution of the profession

It is quite possible that the reason why there are so many poor engineers is *because* there are so many poor engineers. There is a principle in economic science known as Gresham's Law, accounting for the fact that when there are two legal systems of coinage of unequal value the poorer will drive the better out of circulation. Is there a similar law exerting its baleful influence in the engineering profession? A mature graduate of any engineering school, when looking over a recently published roster of his class, finds that a large proportion of his classmates are not engaged in professional engineering practice. Many will be found in various echelons of management where an engineering background is a distinct asset, but a surprisingly large number will be listed in occupations not even remotely related to engineering. One of my classmates is a very personable master of the dance and owns a lucrative chain of studios. Another who made an exceptionally fine record as a student is the proprietor of a retail shoe store.

We hear much these days about a shortage of engineers. I venture to state that if all the engineering graduates who have wandered afar could be lured back to the field of their first choice we would have an ample supply of professional engineers. How can we account for this incongruous state of affairs? I, for one, believe that the same principle that underlies Gresham's Law has universal application and therefore includes the engineering profession. The superior is being driven out by the inferior.

When the employer cannot perceive or is indifferent to the quality of the work produced, craftsmen of lesser skill get the jobs; by paying lower wages to inferior workmen the employer thinks he is saving money. One need not go to college to learn how to make an acceptable survey or to run a line of levels. Any high school graduate grounded in basic elementary mathematics can qualify, but the going may be tough in laying out work from a complicated set of plans, and he might be quite innocent regarding the significance of such esoteric terms as azimuth, right ascension, and second-order triangulation. Then, too, we have the handbook artist. He

"There is no affinity between engineering skill and political skill; they are completely different."

* * *

"True leadership . . . . is an earnest and sincere application of the principle of give and take which evokes loyalty and a devotion to duty in all who serve."

"Many gifted scientists and engineering specialists who attain eminence in their fields do so at the expense of their justly deserved material benefits . . . . Society is much beholden to them but seldom pays its debt."

* * *

"No professional society can blossom out as a labor union. . . ."

"By paying lower wages to inferior workmen the employer thinks he is saving money."

* * *

"It is certain that no union cards will be found in the pockets of the leaders of the profession or of those on the way up."

—Quotations from Mr. Glidden's article

does very well when the tables and coefficients fit the current problems, but when confronted by the unique or the unusual, his undisciplined imagination runs wild, spewing forth weird concoctions which may be extravagant, unsafe, or both. How true it is that "a little learning is a dangerous thing"!

But the sad part of this situation is that in time some of these amateurs become inoculated with the idea that they are professionals, and are qualified to assume all responsibilities as such. With the aggressiveness which is the defense mechanism of those who are not sure of themselves, and with the help of friends who grant favors that cost them nothing, they insinuate themselves into positions of minor executive capacity and sometimes by manipulation and intrigue move higher. Here their technical deficiencies escape notice, and work requiring engineering skills is delegated to subordinates who as budding engineers are only too eager to apply their newly won training. In time many of these willing work-horses, these ambitious young engineers, evaluate the horizons ahead and change employment; some of them salvage what they can from their engineering training for use in allied industry, and others abandon the profession completely.

In private enterprise, under the stress of competition, the productivity of personnel is constantly subjected to rather close scrutiny. In the public works field pressure for productive management is not so great, and a large segment of administration is not interested in earnings and dividends. It is not surprising then, to find many officials in the public service bearing the title of "engineer" who do not possess even the most rudimentary qualifications for such a designation. To a large extent these conditions furnish the clue to the widespread mediocrity which any keen-minded observer will discern in the field of public works, particularly in the more backward areas of the country.

Licensing and civil service

One may ask, "How about the licensing laws?" Unfortunately these laws do not generally apply to engineers in the public service. I think they should, and I think all grandfather and eminence clauses should be eliminated. Every candidate for an engineer's certificate should be subjected to a comprehensive examination. We have had licensing laws of a sort since 1908. But to eliminate present abuses, such laws should be strengthened at once, and made applicable to all engineering positions whether or not in the public service. Action now is not too soon; it will take a generation to cure present evils.

One may also ask, "How about the civil service"? I have heard much debate concerning this question, and volumes have been written on the subject. The scope of this article does not permit a discussion of this topic but I have long observed that when government employment is under civil service regulations the salary ranges are higher, and the engineering work is of superior quality. The taxpayers apparently get more for their money.

Nothing that has been stated should be taken as a disparagement of self-educated, self-made men. While they seldom reach the top positions in today's great organizations, where leadership is achieved by minds trained early in their development, their strength of character and purpose furnish much of the mass essential to the momentum of progress.

Technical training and educational attainments, while of the utmost importance, do not of themselves guarantee the rewards of great achievement.

The odds are weighed heavily in favor of those who possess trained minds, for after all, education is distilled experience. But a man who has acquired the advantages of a higher education through his own efforts has thereby demonstrated the qualities of determination and persistence requisite for high-level positions. And there will always be those rare individuals who with scant educational background are outstanding in attributes of character and leadership. Such people should not be overlooked when there are openings for advancement. In recent decades, educational patterns have changed, and there is increased probability that such persons will not be considered early enough in their careers so that their potentialities can be realized to the full.

In any great organization there must of necessity be only a very few positions requiring exceptional qualities of leadership, and it is essential to our social order that such positions be occupied by exceptional individuals. There is a growing trend not to await the emergence of such people from the matrix of the employed personnel but to seek them out for deliberate training and development. It should be emphasized that such selections are in the interest of society and that the abuses of nepotism, favoritism, and social prejudice cannot be tolerated.

Success is for the audacious

There is a saying, "None but the brave deserve the fair." So it is with success. Prominent characteristics of men of high achievement are superlative courage and a willingness to accept risks. Such men are stimulated by adversity, which they meet with energy and resilience. They consider various courses of action to meet an opportunity, which is quickly seized when presented, and they give little thought to the possibility of failure. One would search in vain for any textbook material that would inculcate such qualities in an individual, although formal education may impart the capacity for analysis and provide wisdom where the basic soil is present for cultivation.

Herein lies one of the basic weaknesses of technical and scientific education. We are taught to be speculative but not to speculate. We become immersed in the grand framework of science and the possibilities to be achieved in scientific advance. There is emphasis on precision and mathematical infallibility. In engineering design we learn about factors of safety and the dire consequences of taking risks. The whole trend is towards a conservatism that rules our daily living and outside contacts.

It is not surprising then that many gifted scientists and engineering specialists who attain eminence in their fields do so at the expense of their justly deserved material benefits. They become so absorbed in their intellectual pursuits that they neglect their personal interest. Usually they live modestly and without ostentation, and if their most pressing economic needs are met, they do not become acutely aware of their inferior financial status until an emergency arises which could become tragic. These are society's forgotten men. Society is much beholden to them but seldom pays its debt. Honorary degrees do not pay doctor's bills nor are monuments legal tender for the undertaker.

The seed of leadership

In engineering organizations, top administrators are drawn most frequently from the division chiefs who occupy the second line on the organization chart. The division chiefs who are most specialized are the least adaptable for overall executive control because of lack of familiarity with the overall objectives of the organization. On the other hand, those division chiefs whose specialties require a broad general knowledge of engineering practice, usually possess the intellectual equipment requisite for success as top executives.

Administrative positions involve better immediate prospects in terms of salary and status than technical specialization, although outstanding technical achievement, much rarer than executive ability, carries financial and other recognition more important than those

(*Continued on page 90*)

Third article in a series sponsored by ASCE Hydraulics Division's Committee on Research

F. R. BROWN, M. ASCE,

Hydraulic Engineer, Waterways Experiment Station, Vicksburg, Miss.

SPILLWAY RESEARCH

at Waterways Experiment Station

A piece of equipment that has been particularly useful since its construction at the Waterways Experiment Station at Vicksburg, Miss., is a large flume, Fig. 1, used chiefly for studies of a fixed spillway crest shape of the ogee type. The approach floor upstream from the crest section is adjustable to permit change of depth as desired. A tailgate permits adjustment of tailwater level.

Although ogee-type spillways are usually designed so that the shape fits the path of flow over a sharp-crested weir at maximum discharge, the assumption that filling the area beneath the nappe with concrete would have little or no effect is not necessarily correct since the pressures along the under surface are no longer constant or atmospheric.

In an attempt to standardize the shape of spillway crests, the Corps of Engineers made a review of all available literature. It was determined from this analysis that, for a vertical-faced spillway of considerable height, the portion of the spillway upstream from the crest should be shaped to a compound curve with a radius of 0.5 H_d to a point 0.175 H_d upstream from the crest, and a radius of 0.2 H_d to a point 0.282 H_d upstream from the crest. The compound curve closely approximates the elliptical path of the under side of the nappe as it springs free of the sharp crest and was preferred for ease of construction. An exponential curve of the form $X^{1.85} = 2\,H_d^{0.85}\,Y$ was selected to fit the downstream part of the spillway.

The crest shape was molded of concrete in the test flume, and attempts are being made to evaluate the effect of such variables as approach depth, head, use of crest piers of various types, use of tainter gates, downstream shape, depth of exit area, and tailwater elevation. To assist in evaluating the effect of the various changes, a 4-in.-wide section containing piezometers was installed as part of the crest. This section was constructed of machined templets faced with brass. Piezometers were $^1/_4$ in. in diameter and very accurately located perpendicular to the spillway face. Crest piers are of plastic and can be removed entirely or moved laterally to permit the measurement of pressures at various distances from a crest pier.

Carefully controlled tests have provided information on the coefficient of discharge for various head and approach depths (Fig. 2). The data shown are for spillways with a vertical upstream face and fixed crest shape. It is to be noted that data were procured for heads in excess of the design head. Additional tests are presently under way with a view to designing the crest shape for some predetermined negative pressure at maximum head. Thus, for those heads which would exist under normal operation, pressures would be more nearly atmospheric.

The use of crest piers also influences the value of the coefficient of spillway discharge. However, their effect is usually taken into account by reducing the net spillway length in accordance with some assumed pier contraction coefficient. Variables which affect the value of the pier contraction coefficient are the shape and location of the upstream nose of the spillway crest pier, the head, and the approach depth. Another important variable is believed to be the ratio of the head on the crest to the width of gate, although no data are yet available to evaluate the effect.

The equipment has also been useful in general studies to determine the effect of tainter-gate location, effect of elevation of downstream floor, and the design of various types of energy dissipators. These data and the data previously mentioned will be incorporated in a series of reports to be published in the near future by the Waterways Experiment Station. This Corps of Engineers laboratory operates directly under the supervision of the Office, Chief of Engineers.

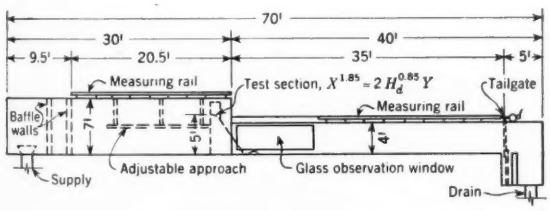


FIG. 1. Flume 70 ft long and 6 ft wide has depth sufficient to accommodate spillway models 5 ft high. Flow into flume is measured by several venturi meters and baffled before it enters reservoir area. Maximum water-supply capacity is about 20 cfs. Note glass panel in far end of near wall, which facilitates photographing of spillway performance. Steel rails on walls provide datum plane.

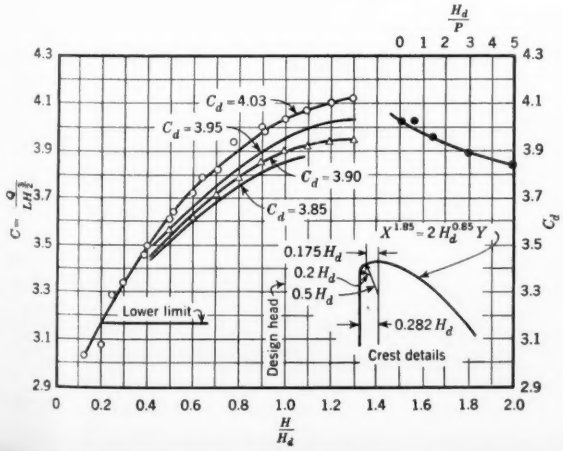
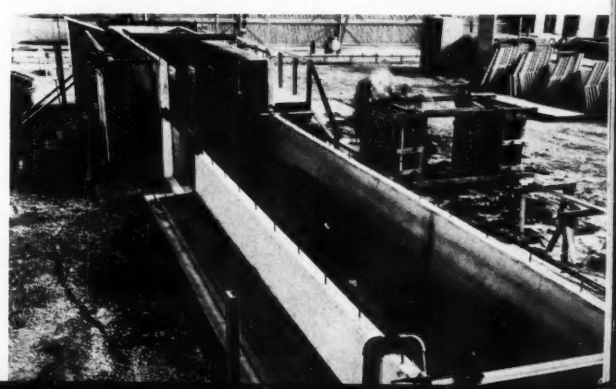


FIG. 2. Spillway discharge coefficients are given by curves at lower left, all based on experimental results. H = total head on spillway, including velocity of approach; H_d = design head on which spillway shape is based; C = coefficient of discharge; C_d = coefficient of discharge at H_d; P = height of weir.



EXPLORING for hydro power in

GORDON L. WILLIAMS, M. ASCE

For a third of a century, the Brazilian Traction Light and Power Company and its subsidiaries, commonly called "The Light," have carried out explorations in areas within transmission-line reach of the large load centers—Rio de Janeiro and São Paulo. The exploratory projects mentioned in this article (one of which is described in detail) took place between 1949 and 1953 and represented expenditures approaching a million dollars a year.

Selection of a site for the development of hydroelectric power is relatively simple after all the necessary information has been collected. Obtaining that information with maximum economy is the principal part of the problem. Basically, water power is obtained from water falling from a higher elevation to a lower one, through pressure conductors and turbines. If the engineer is fortunate enough to have contour maps of the area under study, he can locate a river at a relatively high elevation and a nearby valley that is much lower, or a gorge, waterfall, or series of rapids. He can then select possible sites for dams, tunnels, penstocks, power plant, and tailrace without ever setting foot on the continent concerned.

However, dependable topographic data are rarely available for undeveloped areas and in such cases long and expensive explorations may be necessary to develop the information on which to base a wise choice of site. Vast areas in Brazil fall within this category. Some regions, within transmission-line reach of the large load centers, Rio de Janeiro and São Paulo, have for many years been under intermittent study by subsidiary companies of the Brazilian Traction Light and Power Company, commonly called, "The Light."

São Paulo, the fastest growing large city in the world, is about the size of Chicago, and at an elevation higher than Chattanooga's famed Lookout Mountain. It is as near the coast as Houston or Los Angeles, and has a more temperate climate than either. Largely because of the invigorating climate and the cheap electricity made available by the world famous Serra (or Cubatão) Development, industrial growth has been rapid, outstripping all the utilities, including the power supply. This state of affairs, following World War II, resulted in a diligent search for additional hydro sites—a search in which I took an active part.

The previously mentioned Serra Development, begun in 1924, has been described in many publications, the most recent being the biography of the late A. W. K. Billings, Hon. M. ASCE, by A. J. Ackerman, M. ASCE. This project diverts water from the great Rio de la Plata Valley to the sea near Santos, Brazil. The diversion from the headwaters of the Tieté River—a tributary of Rio de la Plata—utilizes a direct power drop of 2,350 ft over the escarpment to sea level, a drop that would otherwise be dissipated over nearly 2,000 river miles via Buenos Aires and Montevideo.

In the concession for the Serra Development, officials of The Light had the foresight to include several streams on the plateau that might be added to the diversion at a later date. Two of these streams, the São Laurenço and the Laranjeiras, are not tributaries of the Tieté, but feed the Juquiá, which runs southwest along the rim of the plateau, and gradually breaks down from it over a distance of about 100 miles, to join the Ribeira River practically at sea level. See Fig. 1. An erroneous map gave the company the impression that the São Laurenço and Laranjeiras could be readily diverted from the Juquiá to the Tieté by means of a gravity tunnel.

In 1927, a group of surveyors under the direction of W. L. Zeigler, M. ASCE (now a Life Member), ran some random survey lines—or fly lines—along these streams and discovered that such a diversion would require higher dams, more pumping, and longer tunnels than

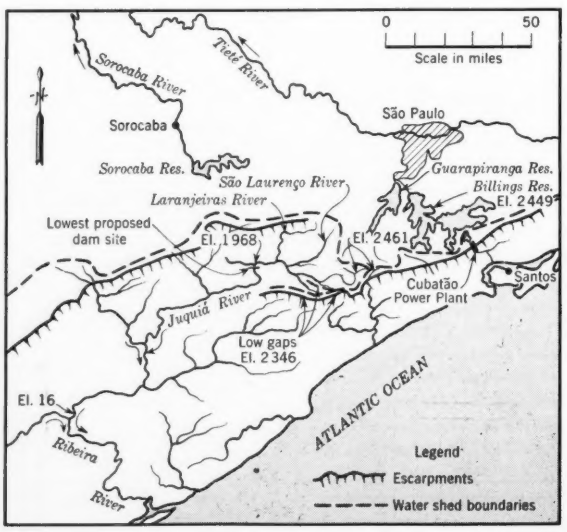
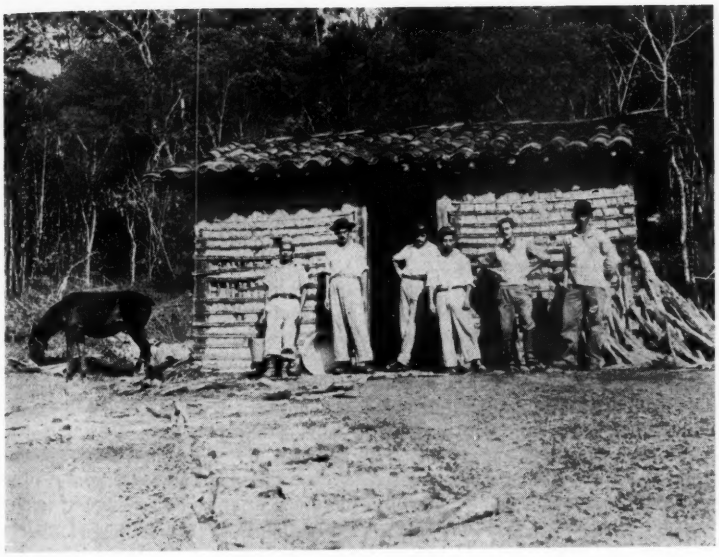


FIG. 1. Area to the southwest of São Paulo, Brazil, a fast-growing load center. Similar and sometimes more remote areas have been under intermittent study for many years in search for economical hydro development possibilities.

unmapped Brazil

Harza Engineering Company, Chicago, Ill.
Formerly Assistant Manager, Planning Dept.
São Paulo Light & Power Co., São Paulo, Brazil



Abandoned cabin of sticks and mud was last remnant of civilization on one exceptionally tough survey line. Cabin was used for kitchen of survey camp. Even the mule soon had to be left behind because of hard going in steep hills and jungle.

Steep cut on old logging road indicates how decomposed overburden—mostly granite—will stand.

could be justified by the amount of water obtainable. However, in the course of a year's work in dense jungle, the party discovered a possible diversion that would yield considerably more water—a diversion that the writer, with three times the manpower, twice the time, and finally with the aid of aerial maps, was unable to improve upon except in detail. Engineers like these, in obscure corners of the world, have written many chapters that our academic historians will never discover.

According to this 1927 scheme, the Laranjeiras and São Laurenço would be allowed to flow into the Juquiá, which would then be backed up to its source near the Guarapiranga Reservoir, a source of both water and power for São Paulo. Two possible routes were discovered for the diversion. One was a tunnel running directly from the Juquiá

Good means of moving an immobile jeep is demonstrated by geologist P. P. Fox, M. ASCE. Yet actually jeep is most satisfactory means of transportation in this type of country. Winch, however, is frequently essential.

to the Tieté Valley, and the other a little less costly, involved a tricky and longer route into and out of a third valley. The 1927 plan required the construction of four dams along the Juquiá. The three upper dams would have pump lifts totaling nearly 350 ft. The upstream pool would discharge into a tunnel and thence to the Guarapiranga Reservoir and on to the presently constructed Cubatão Power Plant.

When the studies were resumed late in 1949—some 22 years later—we were so sure of one of the dam sites that we quietly bought it up to avoid land speculation, and we began an intensive investigation, both topographical and subsurface. Our surveys were based on a few of the original iron pipes left as permanent markers in 1927, which we were able to uncover. Much to our dismay, we soon learned that the surface of the underlying rock at the proposed dam site does not rise with the ground surface on both sides of the river, but rather remains at river level, or even below it, so that decomposed materials overlie the rock to a considerable depth. While this foundation would present no problem in planning an earth dam, a major problem would be involved in locating a diversion tunnel through it for handling the river during dam construction and for subsequent pumping purposes.

Again, diamond drilling for a tunnel site at the selected point of diversion into the Tieté Valley showed rock to be at great depths; a depth of 300 ft in the ridge gaps was not unusual. This seems odd in a region that is made up entirely of steep hills, not unlike the foothills of the Ozarks or Appalachians. Because of the great depths of decomposed rock encountered, we turned our thoughts from tunneling to canal cuts 100 ft or more deep. This was at the suggestion of our geologist, P. P. Fox, M. ASCE. An inspection of new railroad cuts and old road cuts, such as that shown in an accompanying photo, indicated that the decomposed material—mostly granite—would stand up well on steep slopes.

Owing to the urgency of the investigations, simultaneous explorations were made on five possible dam sites chosen from the 1927 data. All five sites disclosed the same difficult subsurface situation, and all were in regions where impervious fill was abundant, but where almost no porous fill was to be found.

Surveys were run along the divides leading from each dam site to the southeast rim of the watershed, then along the rim to check for gaps that would require saddle dams. From some points along this rim, near the escarpment, it is possible to see the Atlantic Ocean, 15 miles away and 2,500 ft below.

This was a particularly difficult surveying assignment. Along this river, as along most rivers in the area, there is a trail with cabins perhaps five miles apart. The abandoned cabin shown in a photograph represented the last remnant of civilization on what was probably the most difficult of these surveys. A short distance beyond this cabin the going became so rough, through a maze of steep hills and thick jungle, that even the mule had to drop out of the party, leaving the men to pack in their own supplies. Since there was no game, food was the principal problem. When this party became little more than a spread-out supply line, another party leapfrogged on ahead of it and was able to carry through to meet a third party working in from the opposite direction.

For many years, The Light has made it a policy to train its own surveyors, employing natives with little or no schooling. On jobs such as this, the policy proved its worth. It was common practice for the parties to work 5 or 6 miles from their camps, and the camps were sometimes 5 or 10 miles from the nearest truck or jeep road.

Following the divide along the southeast rim of the Juquiá watershed (Fig. 1), as it wandered through a trackless region, resulted in a very circuitous survey. Choosing the right ridge to follow was always a guess. Many lines, after leading merrily onward for several days, would suddenly stop abruptly at the fork of some creek. The work was often discouraging, but it did bring to light a few gaps, at very inaccessible places, where saddle dams would be required. These and other discoveries eventually led us to abandon all the original dam sites except the one farthest downstream, which was at the lower limit of the watershed for the proposed diversion.

At about this time the aerial photographs we had ordered of the region began to come in. The only ground control for the aerial mapping consisted of the numerous fly-lines we had run along ridges, valleys, and a few roads. Nevertheless, crude maps made from these photographs turned our closed-in jungle into an open book. Mere sketches showing ridges and valleys, and trails—where they were visible through the trees—supplied excellent orientation for our work. We could tell which ridges were divides, and which were not. We could pick out the lowest gaps for ground checking of elevations, and select the most promising routes for reaching them.

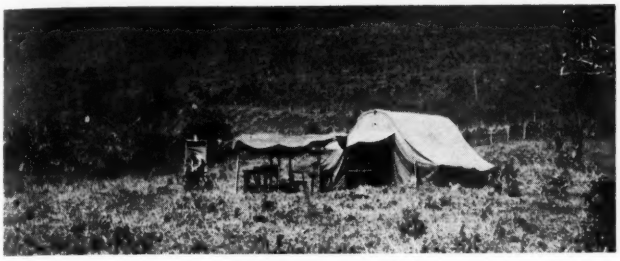
By following a high ridge from the edge of the watershed in to the river, rather than working outward from the river, we came upon a dam site that would replace at least two of the ones previously considered, and by spot checking the lowest gaps we eliminated saddle-dam worries. The dam site had been cross-sectioned in 1927, but had never been considered seriously because it is not as narrow as one just downstream from it, and it is just upstream from a principal tributary stream. The newly proposed site proved to be on a granite dike—the only exposed sound rock discovered in many miles of searching.

By using the aerial photographs in stereo pairs, we were able to lay out a water route at the head of the Juquiá Valley which was far more complicated than any which conventional route surveying could be expected to disclose. We discovered that some distance inland along a very low, flat branch of the Juquiá, there was a good site at which water could be pumped from that branch through a rather deep cut into a high-level tributary of the same river. Then, by a series of small dams and canals, the water could be backed up one branch, allowed to flow down another, then up a third till it reached the tricky 1927 diversion possibility previously mentioned. This route, lying well inland from the escarpment, avoids the low gaps to the sea that had been so hard to discover, and would be still harder to close with saddle dams. The need for one major dam was also avoided, so that the final scheme required only two major dams and two pumps lifts.

A detailed account of this investigation has been given because it illustrates some of the problems encountered in this type of preliminary survey. It also shows the remarkable advantages to be obtained from a minimum amount of aerial mapping. The discouraging part of this particular investigation was that just as our engineering studies were being completed, and a solution to our physical problems had been found, The Light lost the concession politically to a company that proposed to develop a small block of power available at a waterfall at the downstream extremity of our project.

Investigations of four other major projects followed more or less the procedures that have been described. The main exceptions are that in one case we resorted entirely to land surveying in determining proposed reservoir volumes totaling nearly 1,500,000 acre-ft; and in another case complete aerial mapping was ordered for proposed reservoirs and possible diversion routes. In the first of these cases aerial photos would have been a great help; in the second, the complete aerial map was hardly warranted, since it did not materially reduce the necessary land surveying. In two other cases, as in the Juquiá example above, we used only aerial photos and sketch maps made from them. One of these investigations extended over a 100-mile length of almost completely unmapped valley. Aerial photographs in the most mountainous part of this

Camp trailer outfit provides lodging for six-man reconnaissance party. Trailer is inside tent, supporting it and serving as central feature for bunks and storage bins. One-bucket shower bath is in the open, at left.



A very good dam site is here shown—less abrupt ones may be missed in following the meanderings of a river unless possible sites have previously been marked on chart. To study a river, the engineer should travel every inch of it.

region proved to be almost essential, and in the rest, very desirable. From them, gaps, possible spillway sites, access routes, and diversion sites were picked out with great facility. These were then readily checked by land surveys.

On these explorations aerial photography, combined with land survey data, brought about a better project than either method could be expected to disclose alone, without a material increase in cost.

Whether or not good maps are available, it is necessary on such investigations to follow through by site topography, surface investigations, and a continuous collection of hydrologic and meteorologic data. Aerial photos are frequently of value on this work also.

Means of travel

Travel over such widely spread out activities is essential but is something of a problem. Generally, a jeep is the most satisfactory means of transportation. It can go almost any place that can be reached by ox cart. Its clearance, much less than that of an ox cart or even a truck, causes trouble where the ruts are deep, but because of its narrower gage, the wheels on one side can frequently be kept out of the rut. Because of its low clearance, stumps are a real hazard, especially to the tie rod in front of the front axle. Oversized mud-grip tires are a great help in deep mud.

For the transportation of two or three persons, a winch on the front is very effective in pulling out of holes, but if several men are handy for pushing, the winch is not essential. A heavy front bumper, with an eye on one end, provides a good place to hook a snatch block in running a rope from the winch to the rear for pulling out backward. For narrow, muddy roads, it is wise to remove the side steps, raise the license plates and exhaust tail pipe, and remove the spare tire from the side. Generally, the spare tire can be mounted high in the rear. In one case we mounted it over the hood to avoid interference with a trailer hitch. One more good precaution is to personally inspect all jeep servicing—it may save a long walk.

Lodging in out-of-the-way places is frequently non-existent. A photo shows a camp trailer outfit designed for such places. The trailer is inside the tent, supporting it and serving as the central feature for bunks and storage bins.

Travel by horse or mule is about the same the world over. However, the Brazilian saddle deserves special mention as it is usually comfortably padded with sheep skins. It has what amounts to two pommels, one extending out over each of the rider's thighs, reducing the likelihood of his being thrown.

In studying a river, the engineer should travel along every inch of it, preferably, several times. A native dugout canoe with an outboard motor is often much faster and more satisfactory than a motor-driven rowboat of equal carrying capacity. In large rivers a launch would be much more comfortable. A compass, chart, and timepiece are very necessary in keeping track of the boat's position in the meanderings of the river. Unless possible dam sites have previously been marked on the chart, it is easy to go right through them without noticing them, especially if the river banks are high enough to obstruct the view of the hills on each side. Hand-level measurements of the drop at all rapids give a good idea of gradient.

Planning an exploration

Personal experience on these exploration projects indicates the following general procedure as desirable in studying an unmapped region for possible hydro developments:

1. Appraise the area, watershed, and elevations from all the general maps available.
2. Visit the area by jeep, canoe, horseback, or any other means available. Take a good geologist along.
3. Obtain aerial photographs of the entire area, with sufficient overlap for stereo study. The scale can range from 1:10,000 to 1:30,000. The goal is good stereoscopic relief over as large an area as practicable per photo.
4. Study these photographs in your own organization, using engineers with imaginative ideas, not just map makers.
5. From the aerial photos, trace off an uncontrolled map of the region.
6. On prints of this map indicate various dam sites, water routes, and low gaps to be investigated or checked for elevation in the field, and instruct the field parties accordingly.
7. Use this map as a road map to reach inaccessible points, and plot your position on the map at intervals where possible, noting jeep speedometer mileage, or if you are traveling by canoe or horseback, indicate the time you reach various points. You thus determine a scale of travel, either in distance or time. Frequent altimeter notations are also valuable.
8. Visit the field personnel frequently to review any startling discoveries—there will be many—and to change the instructions accordingly.
9. Keep the office layouts abreast of the field work, so as to avoid every unnecessary move in shaping up the project.
10. Determine the approximate economic pool elevations as early as possible. Keep them in mind constantly and adjust them as conditions change.

Most of the investigations that have been mentioned were carried out under the supervision of the writer, and under the general direction of the late O. H. Dodkin, M. ASCE. The first half was under the authority of A. J. Ackerman, M. ASCE. In addition to the ASCE members already named, others who had responsible assignments on this work included R. A. Frey, M. ASCE, Z. Slepetys, A.M. ASCE, C. Salkauskas, A.M. ASCE, and J. W. Forster, J.M. ASCE. The high percentage of ASCE membership on this work was largely due to Mr. Dodkin's encouragement. The outstanding non-member in the work was Dr. Antonio Nami, who was in administrative charge of the surveying and wash-boring parties and supervised the topographic mapping.

Entire bowstring truss, including decentering jacks attached to truss shoes, was hoisted into position by 50-ton Northwest crawler crane with 120-ft boom. Danger of floods from melting snows on Mount Shasta, 10 miles upstream, dictated use of such trusses instead of more conventional falsework. Curved top chord of truss consists of 2-in. lumber glued together, called Glu-lam, to form solid timber. Bottom chord consists of four heavy steel tension rods, with turnbuckles for tensioning. Two bowstring trusses are parallel, 4 ft apart, locked together with struts, braces and steel tie-rods. Trusses were shipped by truck, knocked down.

CHARLES C. MacCLOSKY, M. ASCE

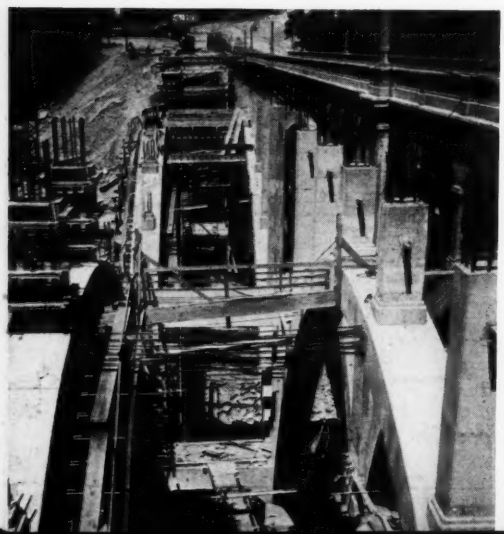
Charles MacClosky Company, Los Angeles, Calif.

Heavy falsework loads carried

Wooden bowstring trusses supporting the falsework for the three-span concrete arch bridge across the Sacramento River at Dunsmuir, Calif., probably carried the heaviest loads ever imposed on such trusses. The longest rib required falsework capable of supporting 4,000 lb per lin ft, making a total vertical load of 400 tons for one concrete arch rib.

Sufficient camber was built into the bowstring trusses so that the total load of the concrete rib after decentering would eliminate this camber. Actual deflections of the falsework were measured, beginning when the trusses were erected and continuing until after they were decentered. These measurements showed that, in Span 2 (the center span, 180 ft long, with a 44-ft rise) the final deflection after decentering was $1^1/_2$ in. at the crown and $1^3/_4$ in. halfway between crown and skewback. In Span 3 (length 114 ft, rise 44 ft), the deflection after decentering was $^3/_4$ in. at the crown and also $^3/_4$ in. halfway between crown and skewback. The deflections in Span 1 (across the railroad track) were not comparable, because this span was supported by a framed wooden tower.

Concrete is placed in column forms by Osgood 200 crane handling bucket from roadway of existing bridge (below right). By altering crane cab, it was possible to keep traffic moving on narrow bridge during pouring. Concreting plant consisted of one-man ready-mix plant, with Willard Weigh Batcher and two $3^1/_2$-cu yd transit-mix trucks. Plant provided 20 to 25 cu yd per hour satisfactorily. In view below left, note reinforcing steel in place for arch-rib struts. Also note 7-in. I-beams set in sides of columns at extreme right to support falsework for transverse concrete cap girders and wood joists for concrete deck forms.



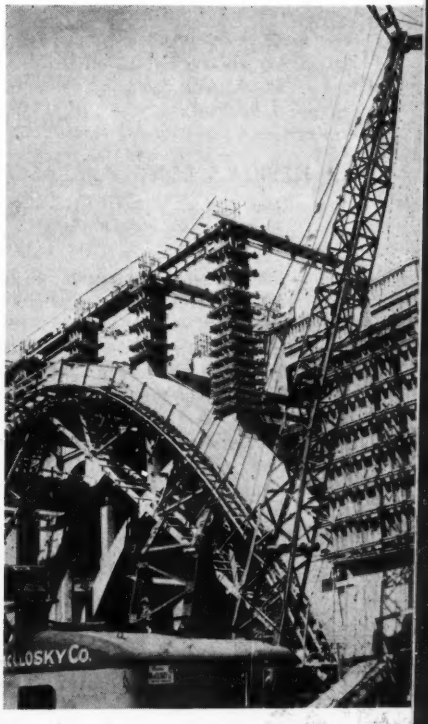
Intrados of arch was formed by nailing 2 × 6 joists to top chord and cantilevering them 4 ft beyond edge to support catwalk and hand rail. By nailing $^{5}/_{8}$-in. plywood to top of these joists, perfect curve for intrados of arch rib was tailor made. Side forms were standard plywood panels with V-shaped junctures between adjacent panels. Forms for extrados, seen in view at right, were held by bolts fastened to 2 × 6 joists. Because

steel tension rods could not be used for bottom chord of truss over Southern Pacific RR, wooden tower was used there (at extreme right in two center photos).

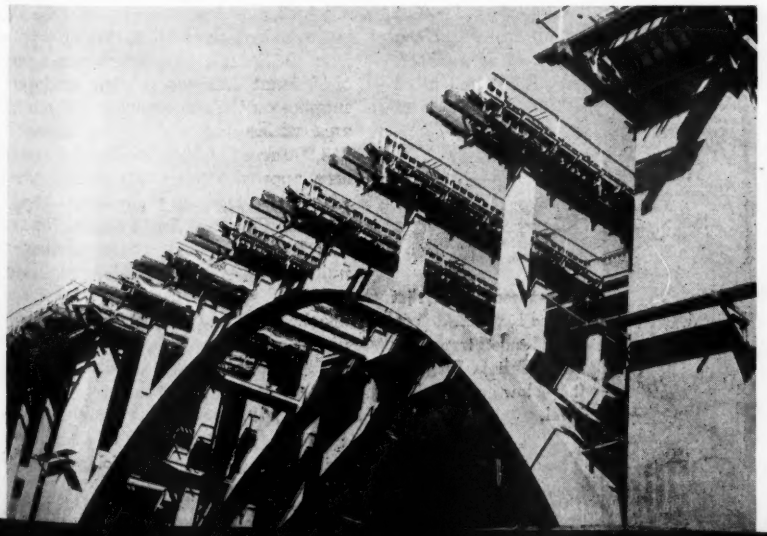
by wooden bowstring trusses

By using separate work crews, the centering for all three spans was struck simultaneously. After decentering, the trusses were hoisted laterally upstream about 20 ft by the power crane and used again for the second arch rib.

Timber Structures, Inc., of Portland, Ore., designed and constructed the bowstring trusses under the direction of Verne L. Ketchum, M. ASCE, Chief Engineer. The contractor who built the bridge was Charles MacClosky Company, with Vern Leiding of Los Angeles as General Superintendent. The work was performed for the California State Division of Highways, with G. T. McCoy, M. ASCE, State Highway Engineer, F. W. Panhorst, M. ASCE, State Bridge Engineer, and F. C. Marshall, A.M. ASCE, Resident Engineer.



Timbers 46 ft long and 8 × 16-in. in section rest on 7-in. I-beams to support forms for cap girders (below). An earlier stage is shown at right, where power crane lifts prefabricated pier form. Column forms were also prefrabricated on ground and lifted by crane with all reinforcement in place.



Of the 70 grout holes drilled in dam foundation under old stream bed, nearly all encountered oil in some degree. Some spouted oil higher than hole here shown. Highest oil pressure measured was 10 psi.

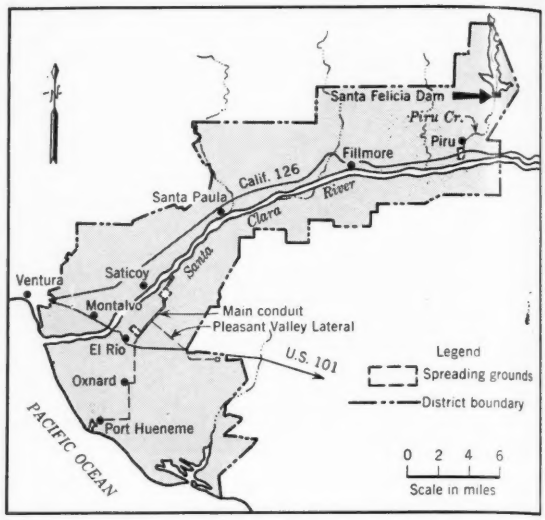


FIG. 1. Famed Santa Clara Valley lies in California's coastal plain just north of Los Angeles. Area will receive increased water supply from Santa Felicia Dam, to be completed in summer of 1955 at estimated cost of $3,500,000.

Oil no boon

in foundations of Santa Felicia Dam

JULIAN HINDS, M. ASCE, General Manager and Chief Engineer

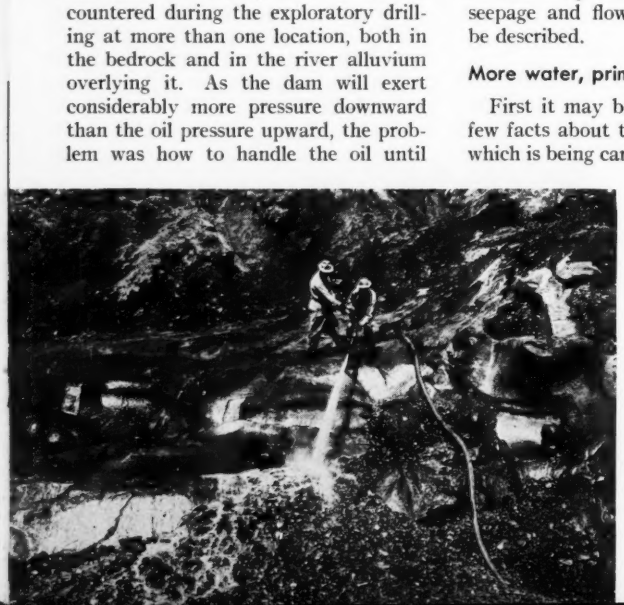
NEVILLE S. LONG, A.M. ASCE, Construction Engineer, Santa Felicia Dam, United Water Conservation District, Santa Paula, Calif.

The presence of oil in the foundation of the Santa Felicia Dam was known before the contract was let, since oil was encountered during the exploratory drilling at more than one location, both in the bedrock and in the river alluvium overlying it. As the dam will exert considerably more pressure downward than the oil pressure upward, the problem was how to handle the oil until the weight of the dam could be imposed. Several methods were found effective for handling the various types of oil seepage and flow encountered, as will be described.

More water, primary aim of project

First it may be of interest to give a few facts about the project as a whole, which is being carried out by the United Water Conservation District. The District includes practically all the habitable part of the Santa Clara Valley in Ventura County, Calif. See Fig. 1. Besides the valley proper, the District includes all of the Oxnard Plain, parts of which now drain directly into the sea but which derives all its water supply from the Santa Clara system, and a part of Pleasant Valley, dependent for future supplies on the same source. The total area within the district boundaries is 213,000 acres, and the habitable or arable area, approximately 143,000 acres. Also within the District boundaries are the cities of Fillmore, Santa Paula, Oxnard and Port Hueneme, and a number of unincorporated towns, including Piru, Saticoy, Montalvo, and the several beaches and communities which make up the environs of Oxnard.

This area supports an extensive and long established agricultural economy, including large-scale production of lima



High-pressure water jet cleans bedrock at bottom of cutoff trench for Santa Felicia Dam, 80 ft below stream-bed level.

beans, sugar beets, truck, walnuts, citrus, avocados and other high-priced crops. Santa Paula boasts of being the lemon capital of the world. Industrial, commercial, and petroleum potentialities are great, and are rapidly developing. The demand for water is growing, and the presently available supply is limited.

To alleviate this situation, a bond issue of $10,939,000 was voted in October 1953 to finance the first step in a contemplated conservation program. This step consists of the Santa Felicia Dam and storage reservoir on Piru Creek, additional diversion and spreading works in the lower river area, and a limited conduit system on the coastal plain.

All the water used within the area comes from local sources and is mostly derived by pumping from the underground gravels. These gravels are being overdrawn, and salt water is moving inward although the coast line. The purpose of the Santa Felicia Reservoir is to relieve or temporarily eliminate this overdraft by catching flood waters which now waste into the sea and releasing them gradually for percolation. Other potential storage developments have been investigated but are not included in the District's present plans.

Santa Felicia Dam, the main structure in the project, is a rolled gravel embankment with an impervious central earth core. The crest length is approximately 1,200 ft; the maximum height above the lowest point of the foundation, 293 ft; and the height above the stream bed, 200 ft. Allowing a freeboard of 20 ft above the spillway crest, the maximum water depth will be about 180 ft. Reservoir capacity will be 100,000 acre-ft. The dam is now under construction by the District near the mouth of Piru Creek (Fig. 1).

The spillway, an ungated ogee crest discharging into a funnel-shaped chute, is located on a bench at the west end of the dam. The discharge capacity with a freeboard of 5 ft is 114,000 cfs. At the point of overtopping, the capacity is 184,000 cfs. The maximum flood peak of record (March 2, 1938) was 35,600 cfs. Spillway design and performance was model tested. The general features of the dam and spillway are shown on Figs. 2 and 3.

Contract for construction of the dam was awarded on April 14, 1954, immediately following the sale of the bonds, to a joint venture consisting of D. & H. Construction Company, Macco Corporation and M. H. Hasler Construction Company, on a unit price basis at an estimated cost of $3,534,826. The total bond-issue cost of the dam and reservoir, including highways and utility relocations, lands, oil rights, reservoir clearing, etc., was $8,000,000.

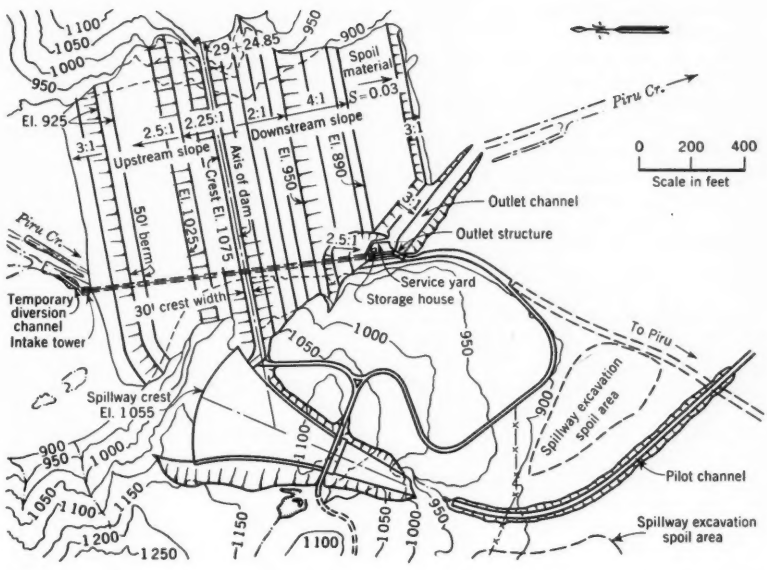


FIG. 2. Santa Felicia Dam and appurtenant works will contain about 4,000,000 cu yd of fill and 30,000 cu yd of concrete. Spillway is ungated ogee crest located on bench at west end of dam, and will discharge into funnel-shaped chute.

As a matter of economy the job was set up on a two-season schedule, without a diversion tunnel. The first season's work called for the excavation and refilling of the cutoff trench (which has an average depth of 80 ft) through the gravels of the stream bed, and the construction of the outlet conduit along the west abutment. Construction of the fill will continue throughout the winter, as weather permits, a gap being left along the east abutment to pass floods. During the summer of 1955 this gap will be filled and the dam topped out in time to store the 1955–1956 flood runoffs and force any possible excess over the spillway.

A point of particular interest in connection with the foundations, the subject of this article, is that the dam is located just downstream from a producing oil structure.

Oil in underlying strata

The Santa Felicia dam site lies within a series of sandstones and shales of the Miocene age which have been conspicuously folded and tilted. The inclinations of the beds at the site are related to a sharp east-west anticline, the axis of which crosses the river about 1,000 ft upstream. As the dam site lies on the south limb of this anticline, the beds dip to the south (downstream) and strike east-west, essentially normal to the river. At the upstream edge of the site the beds dip 50 deg to the south, and this dip prevails quite uniformly over the area occupied by the dam; but to the south,

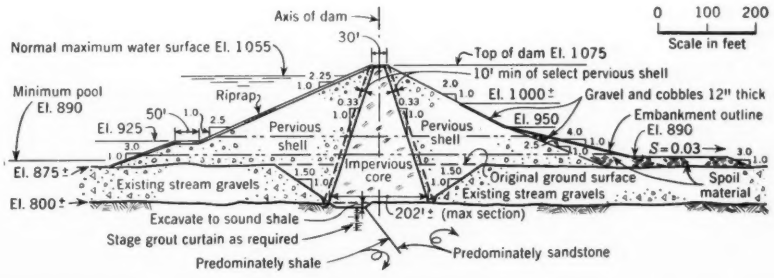


FIG. 3. Rolled gravel embankment with impervious earth core are main features of Santa Felicia Dam, here seen in maximum section. Structure has height above stream bed of 200 ft, providing water storage depth of 180 ft. Reservoir capacity will be 100,000 acre-ft.

downstream from the dam site, the dip steepens.

Oil is produced from this anticlinal structure through a series of wells west of the river. One such well was within the reservoir area, above 1,000 ft upstream from the dam axis, and there are two abandoned wells in the area. These wells and the underlying oil rights belonged to the Pacific Western Oil Corporation from which the dam site and much of the reservoir site were acquired. This corporation was planning the drilling of additional wells across the canyon at the time the site was selected for construction. The District acquired only the surface rights, leaving the oil to be developed by the oil company, but it was necessary to reimburse the company for abandoning the producing well and for surrendering the right to drill within the reservoir area. Further development will be by slant drilling.

For the abandonment the District paid the sum of $200,000, which included the cost of sealing off the producing wells within the reservoir site as required by the State Department of Oil and Gas. In addition to this it was necessary for the district to further seal off the upper portion of one well from which a small stream of sulphur water was flowing and to take care of the two previously abandoned wells, one of which was leaking oil and gas and the other showing a small flow of sulphur water.

Dr. Robin Willis, consulting geologist and petroleum engineer, was engaged to direct this work, which consisted essentially of plugging the wells with cement. However, because of the age of the wells, a number of difficulties were encountered before the job was successfully completed. This work was performed by B. J. Service, Inc., and The California Production Service, Inc.

Sandstones at the site are predominately medium grained and loosely cemented. The shales are variable in character, ranging from silty to clayey. The shales and sandstones are interstratified in a great variety of combinations. In some places the sandstones occur in thick beds with little or no shale. In these occurrences the sandstone is characteristically massive without pronounced bedding planes. Thinner-bedded sandstones usually occur as ribs lying at rather close intervals within the shalier members of the foundation. A few beds of shales without these numerous ribs of sandstone have been found in the downstream part of the foundation and in the spillway excavation, some more than 10 ft thick.

The topography of the site is everywhere steep except in the flat floor of the valley and on the higher terraces formed by the lateral cutting of the river in former times. These terrace flats lie at various elevations above the present stream. There are two such terrace levels in the vicinity of the dam site—one where the spillway will cross behind the right abutment, and another lower one, also on the right bank, south of the spillway terrace. These terraces are covered with alluvium consisting of clay, sand, gravel and boulders, the gravel and boulders becoming more numerous and larger in the lower parts of the deposits.

In an earlier time, Piru Creek cut its valley some 75 to 95 ft below the present level, but subsequently filled the gorge with sands and gravels to the elevation of the present stream bed. Preconstruction drilling indicated that the bedrock floor might be quite flat in the center of the valley, bounded on each side by steep slopes rising to connect with the precipitous cliffs forming the visible walls of the valley. Conclusions reached from exploratory drilling regarding the presence of oil and the general shape of the foundation were found to be essentially correct. However, the floor of the foundation as finally exposed was considerably more uneven than had been anticipated, being composed of massive hummocks and hollows with a maximum variation in elevation of approximately 20 ft.

During the course of the cutoff excavation, it was found, as expected from the exploratory work, that the lower sands and gravels were contaminated with oil. This contamination was first encountered in streaks and lenses, usually adjacent to the abutment. As the excavation proceeded, the contamination became more general, and in the lower parts esentially all the sands and gravels were contaminated with oil.

The specifications permitted the contractor to use all suitable materials from the cutoff trench excavation in the gravel parts of the dam. The oil-contaminated materials were judged not suitable for this purpose, and were wasted.

Upon exposure of the foundation rock, numerous oil seeps were encountered. The character of the seeps ranged from vigorously bubbling oil and gas streams emerging from some of the exploratory core holes to oil slowly oozing from the bedrock itself, part of which was sandstone highly impregnated with oil. However, seeps coming from cracks in the foundation and abutment rock were the more common type encountered. Apparently much of the more vigorous action of this oil was caused by the escape of gas as the pressure on the foundation was reduced by the removal of the overburden. During the six- to eight-week period during which the foundation was exposed many of the oil leaks dissipated themselves, and by the time the foundation was ready for covering the number of seeps that had to be handled was materially reduced.

Oil seeps sealed off

As the pressure the dam will exert will be considerably in excess of the pressure causing the oil to seep, the problem was how to handle the oil until the weight of the dam could be imposed upon the foundation. After several alternatives were tried, a method was found which proved quite successful. Immediately before placing fill on the foundation, each oil seep was sealed off by dry packing with a heavy neat cement mortar. The combination of the cement mortar and the weight of the fill proved adequate for handling the seeps. Several check excavations were made subsequent to this treatment and in no case was any evidence of further seepage found.

Additional oil was encountered during the course of the foundation grouting program. Of the 70 grout holes drilled in the foundation beneath the old stream bed, nearly all encountered oil to some degree. In some of the holes, the oil was under a measurable pressure. The highest pressure observed was 10 psi, in a core hole adjacent to the west abutment. Another hole in the same area presented a geyser-like effect as the escaping gas shot 15 to 18 in. above the top of the grout pipe. This effect was not continuous but pulsating in nature. With only a few exceptions, oil encountered in the grout holes was sealed off by the grouting operations, or by cleaning out the hole to a depth of 10 or 15 ft and quickly packing it full of dry cement. In a few cases where the flow broke through the grout, pipes were capped off.

The grouting program being carried out at the Santa Felicia Dam is quite standard and, with the exception of the oil problem, presents no new or significant features. The objective is to provide a curtain of tight rock extending to a depth of not less than 120 ft into the foundation beneath the dam. This is being accomplished by three-stage grouting of holes spaced generally 10 ft on centers. All holes are first drilled to a depth of 20 ft, grouted, and then redrilled to a depth of 60 ft and regrouted. Every fourth hole is again redrilled to a depth of 120 ft and grouted. Up to the present time, practically all the grout take has been confined to the first 20 ft, there being little or no grout take in the second and third stages.

A considerable number of breakouts

occurred in the first-stage grouting. The number of these in the west half of the channel section cutoff trench was such as to indicate the desirability of a second row of grout holes 10 ft downstream from the first. Generally the length of travel as indicated by the breakouts has been approximately 50 ft radially from the hole being grouted. By December 1, 1954, a total of 3,500 bags of cement had been placed in the dam foundation, mostly in the river section.

The contractor's initial plan for handling the water in the streambed sands and gravels of the cutoff trench excavation was to pump upstream and downstream from the trench. He installed four deep-well pumps, three upstream and one downstream. They were helpful in the dewatering of the work area, but because of the low permeability of the sands and gravels encountered, their yields were not great. Consequently, the number of wells originally contemplated was reduced and the remaining flow was handled by sumps and sump pumps at low points in the excavation during the course of the work. The relatively low permeability of the sands and gravels was an aid in reducing the total amount of water to be handled. At no time did the flow into the excavation area exceed 5 cfs, which was handled without difficulty.

Springs cause difficulty

For all practical purposes, the entire cutoff trench excavation in the river section was accomplished at a considerable depth below the water table, which lay within a few feet of the natural riverbed ground level. Despite the overlying water table, the foundation rocks were notably free from water leaks or springs. This was probably due in part to the fact that much of the foundation rock was saturated with oil. However there were some springs which it was necessary to treat. As the work proceeded it became obvious that the handling of the few springs which were leaking water posed a greater problem than the treatment of the oil seeps.

The first method tried for sealing off the leaks was grouting, which proved generally unsatisfactory. The soft nature of the rock and the difficulty of grouting surface cracks in unloaded areas allowed any leak originating near the surface to find its way around the grouted area. Consequently, a more extensive treatment was required. The area containing the spring was covered with a concrete grout cap, 1 to 2 ft thick, with grout pipes placed at the source of the leaks extending up through the concrete. After the concrete had set, fill was placed over it to a depth of 10 to 15 ft, the pipes being brought up through the fill. Then the pipes were grouted under lower pressure. The object in placing the fill was to provide enough weight to preclude lifting of the slab under the low pressures employed. This method proved quite satisfactory. In a few places where the water leak was occurring at the bottom of a depression in the foundation and was quite small, it was sealed off by placing dental concrete in the affected area.

Extensive cleanup required

In that part of the foundation which was to be covered by impervious fill, extensive cleanup was required to insure a good bond between the fill and the foundation. Most of the bottom of the cutoff trench was washed down with fire hoses. On the abutments where the use of fire hoses is impractical because of the difficulty of handling the water, cleaning is accomplished by an air blast. After the foundation is thoroughly cleaned, it is sprinkled and the fill is placed. To improve the bond of the core to the foundation, the material placed immediately adjacent to the foundation is kept on the wet side of the optimum moisture range.

Part of the area at the bottom of the cutoff trench was sufficiently level to permit the spreading of the core material with a bulldozer and compaction with a sheepsfoot tamper; however, uneven parts of the bottom of the cutoff trench and the abutments generally required hand tamping immediately adjacent to the foundation. One other method of compaction against the abutments, which has been successful in those areas where the abutment is sufficiently even, is to use a loaded 12-cu yd Euclid dump truck as a compactive device. This method has proved successful so long as the lifts are kept 6 in. or less in thickness.

The foundation for the cast-in-place concrete outlet conduit is of interest in this connection because the upstream portion of the conduit is laid on compacted fill, with the valve chamber and the downstream part of the conduit on solid rock. In that part of the conduit placed on rock, the excavation was carried to sound material and backfilled with concrete, where necessary, to the bottom of the design section. The design section was then poured on the rock or on the backfill concrete.

In the upstream part of the foundation, the natural stream-bed gravels, which here range up to 80 ft in depth, were excavated to approximately 25 ft below grade and this trench was backfilled with permeable shell material placed in 18-in. lifts and compacted with six passes of a 50-ton rubber tired roller. The outlet conduit was then poured on this material as a foundation. The outlet conduit is divided into 40-ft sections by flexible joints, except where the foundation is gradually changing from rock to compacted gravel. Two 20-ft sections and three 13-ft 4-in. sections were used in this reach to provide greater flexibility.

Before construction started, enough core holes were drilled in the spillway area to give a fair indication of where rock would be encountered. Excavation in this area has shown that the conclusions reached from the original drilling were substantially correct; however, in an area in the northwest section of the spillway, the rock was found to be 15 to 20 ft lower than originally anticipated. As the contractor had submitted the same unit bid price for rock and for earth excavation on this part of the project ($0.60 per cu yd), no savings accrued to the District because of this decrease in the anticipated rock excavation. The original drilling indicated that there would be an area of approximately 41,000 sq ft downstream from the crest where the rock would lie below the bottom of the slab, up to a maximum depth of 12 ft. Plans called for excavation to rock in this area and the placement of a rolled gravel backfill. The excavation revealed this area to be slightly larger than originally anticipated. The excavation in the spillway area also encountered some oil-impregnated gravel. The oil encountered in this area is extremely heavy and the gravel impregnated with the oil has much the same consistency as a road mix except for the presence of over-size rock. The contractor on the job did use some of the material for the construction of a temporary road and it proved to be very satisfactory for this purpose.

The writers are indebted to Roger Rhoades, consulting geologist to the District, for the geologic background material presented in this paper. W. J. Darkenwald, Vice President and General Manager of D. & H. Construction Company, is Project Sponsor. T. B. Kelley, and later George J. Renauld, were project managers for the contractor during the period covered. Eugene C. Kimball is president of the Board of Directors of the United Water Conservation District, and the writers are General Manager and Chief Engineer of the District, and Construction Engineer, Santa Felicia Dam, respectively. W. P. Price, Jr., M. ASCE, is Assistant Chief Engineer of the District.

(This article is based on the paper by the authors presented at the San Diego Convention, at the Soil Mechanics and Foundations Division session presided over by F. J. Converse, M. ASCE.)

WORLD HEALTH—

sanitary engineering can make a great contribution

FRANK M. STEAD, M. ASCE

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This discussion of the opportunities for sanitary engineers in the World Health Organization program also points the way toward some interesting new solutions to basic sanitary engineering problems all over the world. It is especially timely in connection with World Health Day, observed on April 7, to mark the anniversary of the activation of the constitution of the W.H.O. on April 7, 1948.

The constitution of the World Health Organization begins with a statement of basic principles that, like the preamble to our national Constitution, sums up the essence of a heritage of mental growth compounded from hard-headed realism and high idealism. No one is likely to take exception to these high ideals, but in attempting to apply them, one is jolted sharply back to earth by the cold and realistic facts of life.

One cannot attend the solemn and sober sessions of the World Health Assembly, as I was privileged to do last May, without realizing that this organization furnishes the theater where international policy and statecraft are fused with the unfolding fields of the science of human beings. It is this double-edged characteristic of intermingled policy and science that constitutes both the weakness and the strength of the W.H.O. Both were dramatically illustrated at the Seventh World Assembly last May in Geneva. The weakness was shown by the fact that, in spite of almost overwhelming evidence of need for an expanded program, international policy dictated that the budget be frozen at less than half that of the California State Department of Public Health. At the same time, the strength of W.H.O. was shown by the fact that it functioned successfully, held together by the cement of a deep common purpose, during the very weeks that the five-power Asian conference only a room away was hopelessly deadlocked for lack of such a common bond. This fact is the more remarkable when it is considered that, in the World Health Assembly, the alphabetical seating of the seventy-odd countries often places ancient enemies side by side.

It is against such a background that we must view the role of the sanitary engineer in W.H.O. In addition to the new factor of being a prominent player in the game of international politics, he now enters an almost fantastic world where nothing is familiar and where his most cherished assumptions are proven either inapplicable or false.

For example, in this country we think of water demands as adding up to over 100 gal per capita per day in urban areas and an equivalent amount per square mile in agricultural areas. These needs are unquestioned. There is no thought that the cost will not be accepted and paid, or that the established patterns of water systems will not apply.

Now consider some of the experiences which the W.H.O. staff have faced in the simple, straightforward effort to solve a water problem. One day a member of the engineering staff of the W.H.O. came upon a sight familiar throughout the Mediterranean and Asiatic parts of the world—a man driving a donkey round and round a well to turn the works of a crudely designed wooden well pump, operating on a bucket system. Becoming interested in the economy of energy aspects, this engineer set down the data relating to yield of the land being irrigated, time spent by the man and animal, and made some rough calculations. Imagine his surprise to learn that roughly half of the time of both man and donkey was needed to operate the well, and that the animal alone consumed half the yield of the field.

One of the early projects sponsored in part by W.H.O. involved the installation in several countries of small community drilled wells. Water was to be pumped by centrifugal pumps driven by one-cylinder gasoline engines. These engines were cranked with a rope in the same manner as the outboard motor on a boat. Hundreds of these installations were made in villages, and the natives were trained in their operation. Upon recheck later, almost all were found out of use and the people dependent upon the original unsuitable water sources. Investigation revealed in almost every case one of two causes of breakdown—"out of gas" or "lost the rope." The point of these two illustrations is not that the natives were not intelligent, for this was definitely not the case, but rather that the assumption is utterly false that problems in other parts of the world can be solved merely by importing our own patterns, equipment, and materials.

A delegate from one of the African countries described to me a mobile water system used by the nomadic tribes of his country, which seemed humorous to me at first. The camel he said has a water pouch which holds about 30 quarts of water. No matter how contaminated the water that the camel drinks, his enzymatic secretions destroy all pathogenic organisms and keep the water sweet. Consequently, water of potable quality is always available to the nomads in an emergency by stabbing through the camel's skin and tissue with a knife, twisting the blade and filling a water-skin. When the knife is withdrawn, the hole seals tight and without infection. What engineering development of the Western world can compete with this masterpiece of biology?

Far-reaching misunderstandings

In the field of human excreta disposal, the Western sanitary engineer gets perhaps his greatest shock. It is to be expected that the American practice of wasting two of our most important natural resources by discharging hundreds of millions of gallons of water and thousands of tons of organic matter in readily usable form into the ocean every day, would be baffling to people to whom these commodities are prized possessions. Incidentally, there is a rising sentiment in this country that a careful examination of all the values involved will justify a cessation of this practice in the next few years.

A far deeper and more far-reaching misunderstanding is involved in our concepts of excreta disposal by means of the so-called sanitary privy. In early W.H.O. programs in areas infested with water-borne and parasitic diseases, privy-building programs were widely proposed but, in the Mediterranean and Asiatic countries particularly, they always failed. Looked at through the eyes of the native, the answer was obvious. First of all, these Westerners proposed to waste an organic resource that any farmer knew should be returned to the land. That was bad enough in itself, but consider further. A small house was provided as though the act to be performed were somehow shameful and not to be accomplished in the open. Then a chair-height seat was built when any sensible person knows that squatting on one's heels is the physiologically sensible posture for defecation. Finally, and the crowning touch of all, paper was provided for purposes of cleansing. Bad enough that this was far less efficient than the time-honored custom of using water for ablutions. Using paper for this purpose is a desecration. Paper is, in many parts of the world, thought of as a "second God" since, when it bears the printed word, it has the power to awaken and release the mind of man. It is appalling to contemplate how much our prestige must have suffered by our efforts to impose the American privy upon the rest of the world.

What does all this mean? Does it mean that the sanitary engineer, when he enters the international health field, must throw away his slide rule? By no means, but he will have little use for his handbooks. His most important new tools will be a working knowledge of demography, if not indeed anthropology. In the field of his own technical specialty I believe he will need to brush up intensively on basic principles and current basic and applied research.

Frontiers of science may hold the key

Why should he follow current research so closely? One reason is that, in a sense, the undeveloped parts of the world (undeveloped in a material sense, that is) are, as regards sanitary engineering, in a position similar to that in which many remote areas of South America were a few years back as regards transportation. These areas had seen the art of transportation develop only as far as the two-wheeled ox-cart—there were no bicycles, motorcycles, automobiles, or railroads—only to be suddenly invaded by the most modern type, the airplane. In somewhat similar fashion the solution of the sanitary engineering problems of many areas seems to lie in the application of the most advanced research to the local pattern of village living, customs, materials, and power sources without going through the intermediate steps that have been followed in the Western world.

The great epidemic diseases—such as smallpox, diphtheria, and tuberculosis—are still important factors in the well-being of the peoples of the world, but on a long-range basis they are more and more becoming secondary to the simple stark problem of food. Food is the key word and it exerts an accelerating influence on health in many ways. First of all, food, including water, may itself be the medium or transmitting agent for infections and parasitic diseases. Secondly, food builds up the natural defenses of the body against disease. Third, food is the basis of wealth to support the organized services of society and government to protect health, by coping with insects, rodents, and other environmental factors in disease spread, as well as by protecting the health of the individual. Such protection is achieved not only through immunization and inoculation against the directly communicable diseases but also through education toward a more successful way of living. Not only does food make this physically and financially possible, but the successful solution of a food problem instills a confidence and respect that opens the path to men's minds.

Food—most basic problem

Now what has the sanitary engineer to offer on the problem of food? That part of food which is water will, I think, be acknowledged as a field in which sanitary engineering has a vital part to play. For this major part of the food picture also, I believe, the sanitary engineer has the major opportunity to serve. The whole field of sewage and waste disposal through artificial treatment to stabilize organic material, and where necessary separate it from water, has given the sanitary engineer the basic tools that must be used to develop solutions to the food problems of the world. Modern research on the aerobic composting of organic material points the way to greatly improving the efficiency of present methods of returning animal and human wastes to the land, using materials, equipment, and methods available and acceptable to the countries in question, and at the same time completely breaking the chain of disease transmission that now exists. Current knowledge on the symbiotic reactions of sewage and algae offers a real and exciting opportunity of utilizing solar energy to produce protein and fat far more efficiently than by the traditional cycle from sewage to plants to food or milk animals.

Two wasteful and hygienically unsafe practices widely followed in the world result from shortage of fuel. I refer to the keeping of livestock in the same living quarters with humans (with the result that animal manure is mixed with human wastes), and the use of precious animal waste for fuel in areas where firewood is scarce.

Both these problems can be solved by the application of known engineering principles. Dwellings can be designed to take advantage of solar energy for warming, and solar energy can be utilized to cook food, as has been recently demonstrated. In partially built-up communities, even without a water-carried sewer system, human wastes can be anaerobically digested to produce a piped gas supply, at least for cooking. All these measures can be successfully applied only if, in working them out, care is taken to adapt them to the materials, equipment, power sources, and particularly to the customs of the people in the area. These schemes will not encounter the resistance that met the earlier privy programs because they embody conservation of scarce resources simultaneously with reduction in human diseases.

Sanitary engineering opportunities

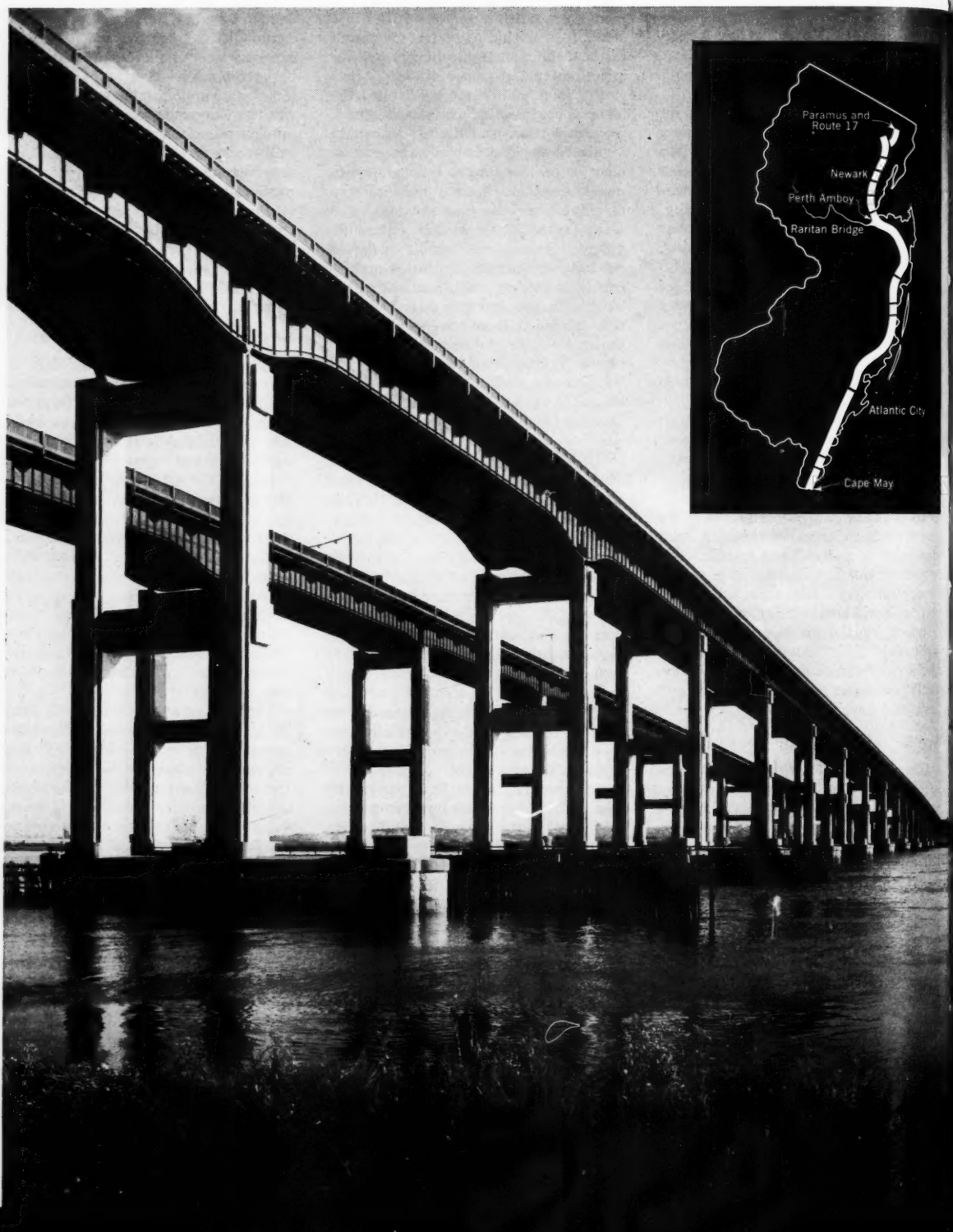
There is a desperate shortage of trained and experienced men to fill sanitary engineering posts in the W.H.O. and its affiliated international health agencies. The superficial deterrents to embarking on such careers—such as language barriers and difficult living conditions for the engineer's family—are not, in my opinion, the real explanation for this shortage. The underlying reason is a fear on the part of young engineers that in entering the field of international health they will be committing professional suicide, since they will not be able to point back to multi-million-dollar projects or to impressive offices and large organizations as evidences of professional stature.

The answer to this attitude is found in the answer to the query, what is engineering? If your concept of engineering is restricted to the application of the laws of nature only to inanimate objects, then surely this field is not for you. Even in this country, however, there is a marked trend toward recognition of the principle that an engineering job cannot be done in a closed, inanimate world, and that sound engineering must always solve problems in the light of both things and people. If this be true, then surely the field of international health may well prove to be a training ground for the sanitary engineering leaders of the future.

(This article is a slightly shortened form of Mr. Stead's address before a Sanitary Engineering Division session at the ASCE San Diego Convention. The session was presided over by R. R. Kennedy, a member of the Division's Executive Committee.)

RARITAN RIVER BRIDGE—

Raritan River Bridge, which carries Garden State Parkway over Raritan River, is almost twin to Edison Bridge 175 ft away. Reason for close proximity of two bridges was need to secure favorable clearances from Department of the Army. Garden State Parkway (see map) extends for 165 miles along east side of New Jersey, connecting metropolitan area with shore resorts.



substructure provides for future widening

C. H. GRONQUIST, M. ASCE, Associate Engineer, D. B. Steinman, Consulting Engineer, New York, N. Y.

Largest structure on New Jersey's new Garden State Parkway, now nearing completion, is the Raritan River Bridge, near Perth Amboy, N. J. This bridge is almost a twin to the Edison Bridge, beside it, although its substructure is designed to provide for the future addition of a third 30-ft roadway. A continuous girder bridge with a maximum span of 250 ft, the Raritan River Bridge was erected without falsework by utilizing improvements in the erection method used for the Edison Bridge.

New Jersey's Garden State Parkway extends for a distance of 165 miles, from Route 17 in Paramus, near the New York boundary, to Cape May near the southern tip of the state, and will provide convenient and safe north-south traffic movement through the New Jersey metropolitan area and to shore resorts at a cost of approximately $305,000,000. The 165-mile length of parkway will be completed by July 1955, and plans are already being prepared for an extension northward to connect with the New York Thruway.

Designed as a twin

To minimize the clearance requirements of the Department of the Army, it was necessary to locate the new bridge adjacent to the Edison Bridge and at a distance of 175 ft from it, center to center, so that the two bridges would have the same span lengths and common channel fenders. Because of the angle of the channel, the new bridge is located longitudinally about 23 ft south of the Edison Bridge.

Since the two structures were to be so close together, it was logical to design the Raritan River Bridge as a twin to the Edison Bridge. Therefore the former was given much the same architectural design and depth of girders as the latter, with some simplifications and modifications. The pier bents of the new bridge are similar in design to those of the Edison Bridge except that provision has been made for the addition of a third column to carry the third roadway projected for future enlargement of the structure. In the present stage of construction, a two-column bent is used, like that of the Edison Bridge, but the pier base and shaft have been extended so that they can receive the third column at a later date.

At present the bridge has two 30-ft concrete roadways with a 5-ft center mall and two 2-ft emergency walkways. The 30-ft roadway is designed for two lanes of traffic with sufficient width to permit two lines of vehicles to pass a stalled car. The future 30-ft roadway, to be added on the west side of the bridge, will be separated from the present west roadway by a 5-ft mall formed by the present west walkway and the necessary width on the additional deck.

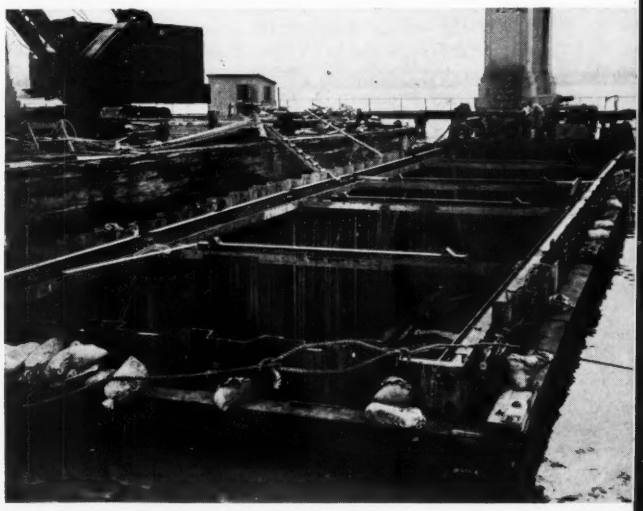
Two lines of girders connected by floorbeams and supporting floorbeam brackets are being used for each stage of construction. Thus the superstructure for each stage is self-supporting and entirely separate in order to permit differential deflection of the two superstructures resulting from live load.

A 7-in. concrete slab with a total cover of $1^3/_4$ in. over the top reinforcing, including a $^1/_2$-in. allowance for the integral wearing surface, is used for the 30-ft roadways. The curbs are structural steel with a continuous slot to permit drainage of the roadway without the use of scuppers or drains. The steel fascia girder is of built-up channel form and supports a substantial steel railing with 8-in. × 6-in. wide-flange posts, and top and bottom channel-form rails connected by 2-in. square tubular pickets. Use of an open grating $3^1/_2$ in. deep for the walkways and mall greatly simplified the concrete work and gave convenient, early access to the entire superstructure work.

Beginning at the south abutment, the 4385.75-ft bridge consists of eight simple spans 132.5 ft in length; two units of three continuous spans each 200 ft in length; one unit of three continuous spans having lengths of 200, 250, and 200 ft; six simple spans 152.5 ft in length; and six simple spans 84.5 ft in length. See Fig. 1. The twelve simple spans on the north side occur where the roadway lies on a horizontal curve with a radius of 8,771 ft. Grades are 4 percent throughout, as on the Edison Bridge, and are connected by a 600-ft vertical curve in the continuous-girder unit at the channel.

Since this bridge is a parkway structure, it is designed for H20 truck loading, in accordance with the 1949 specifications of the American Association of State Highway Officials. The girders are of carbon steel with a constant depth of 12 ft $6^1/_2$ in. back to back of angles, except in certain simple spans, and at the two channel piers where the girder depth is 20 ft $6^1/_2$ in. See Figs. 2 and 3.

Girder depth for the 132.5-ft span is 10 ft $6^1/_2$ in. and for the 84.5 ft span, 8 ft $^1/_2$ in. back to back of angles. Except in the 84.5-ft spans, 26-in. cover plates are used throughout. In the 12-ft $6^1/_2$-in. girders, the flange angles are four angles 8 × 8 in. and are 17 in. back to back, with $16^1/_2$-in. side plates in the 600-ft continuous girder. The girder rivets in general are of 1-in. diameter,



Bases for eleven river piers, of tremie concrete construction, were placed in open steel sheet-pile cofferdams and supported by 14 H 89-lb steel piles with reinforced points driven to rock at depths varying from 50 to 80 ft below water surface.

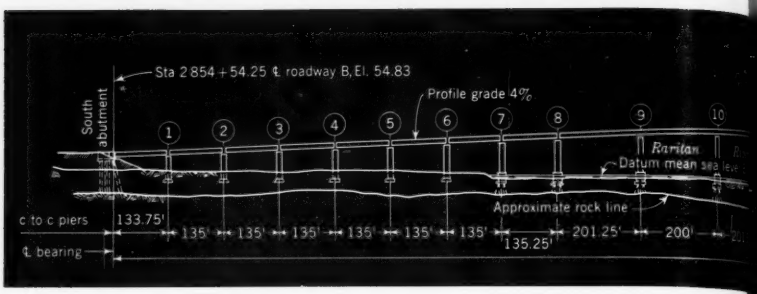


FIG. 1. Raritan River Bridge is continuous girder structure almost 4,400 ft long, with maximum span of 250 ft.

except in the 84.5-ft spans, where rivets of $^{7}/_{8}$-in. diameter are used.

The continuous girders were specified to be shop assembled for reaming of splices in lengths of 300 ft or more. These assemblies were checked for layout and camber.

All bearings are of cast steel except in the 84.5 ft simple spans, where weldments are employed for these smaller bearings.

Fluorescent lighting studied

Extensive investigation, development work, and design were carried out on a proposed low-mounted fluorescent lighting system which would have provided for lighting units 6 ft long set 20 ft on centers, 3 ft 6 in. above the center mall for the purpose of entirely eliminating glare and direct view of the light source. Because of the high cost of this system, and some questions as to its suitability for such an application, a more conventional, high-mounted, mercury-vapor lighting system was adopted.

This system provides twin 20,000-lumen lighting units set 30 ft above the pavement on aluminum standards which are spaced 150 ft apart along the center mall, giving an average initial roadway illumination of 1.5 ft-candles and superior light distribution on the roadway surface. Separate series lighting systems extend from each abutment to the center of the bridge, which marks the service boundary of the two utility companies serving the area. When the third roadway is constructed, an additional line of lighting standards will be added at the east edge of the new deck.

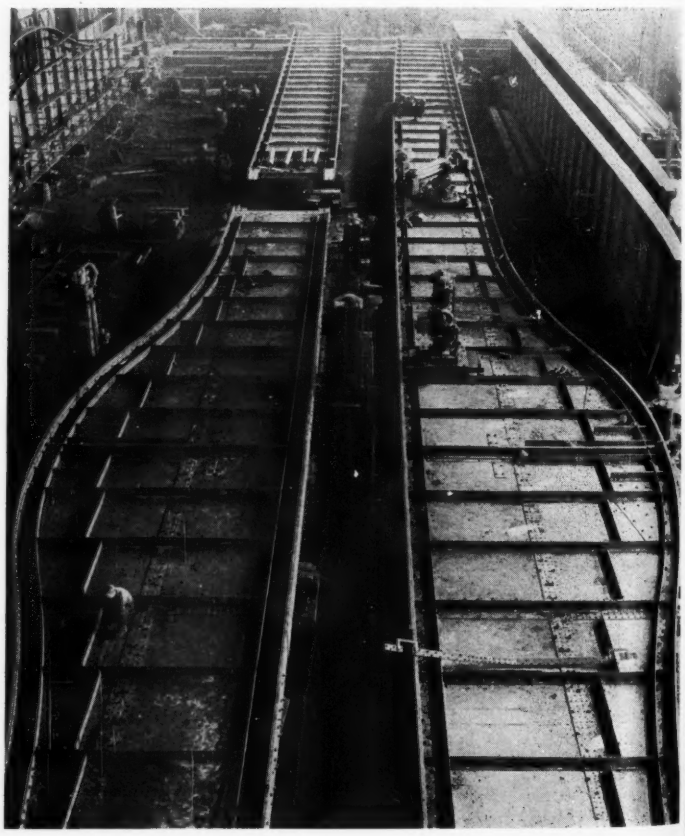
A test installation of anti-glare panels was made on a 500-ft length of the center mall, and is designed to reduce or eliminate headlight glare from oncoming cars. The anti-glare unit consists of a glass fiber-reinforced plastic panel 18 in. wide, mounted between two aluminum posts 2 in. square. The unit is 3 ft high to give a total height of 4 ft above the roadway, and is set at an angle of 60 deg with the curb. The units are spaced 10 ft apart.

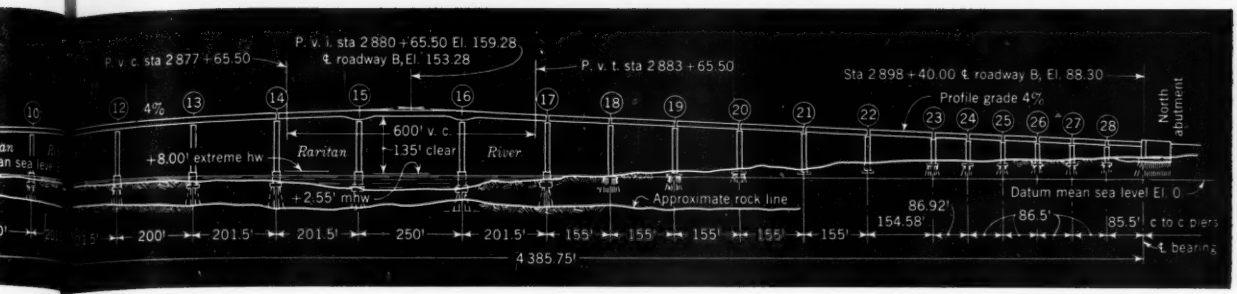
Piers bases built in cofferdams

Bases for the eleven river piers were designed to be of tremie concrete construction, placed in open steel sheetpile cofferdams and supported by 14 H 89 steel piles with reinforced points driven to rock at depths varying from 50 to 80 ft below the water surface. The design load for these piles is 118 tons on the basis of 9,000 psi of main section and 6,000 psi on the point. Comparative preliminary designs for caisson construction proved much more expensive than the adopted design.

After the cofferdam was unwatered, the concrete block on top of the seal, and the granite-faced concrete shaft resting on this block, were placed in the dry. The granite-faced concrete shaft extends to El. + 11 and supports the concrete frame forming the superstructure of the pier.

A pair of structural steel trusses which provide the necessary reinforcing of the concrete struts connecting the columns of the pier frame were designed and used to support the weight of concrete and forms for the struts during construction. The strut reinforcing trusses for the future pier-frame extensions will be





connected to the Stage 1 trusses after removal of the low-grade concrete protection placed around the projection at the west end of those trusses.

The south abutment is supported on steel H-piles driven to rock. The six land piers on the south approach were designed with spread footings founded on firm sand about 25 ft below ground level. The north abutment and nine land piers on the north approach are supported on cast-in-place piles driven to hard clay strata at depths varying from 30 to 50 ft below ground level. Two piers are on spread footings.

Except for Pier 1 on the south approach, which was founded with the use of tremie concrete, the remaining land piers on the south approach were excavated and constructed in the dry in open steel sheetpile cofferdams, since the ground-water level had been lowered by muck excavation for the approach fill south of the south abutment.

The cast-in-place concrete piles for the north approach foundations were of 14-in. constant diameter, of Cobi type.

Channel dredged for access

To provide access for the construction of the river piers where the water is shallow, beginning at Pier 7 at the south shore and extending to the main channel, the contractor dredged a channel to a depth of El. −13 for a width extending from the east side of the pier foundations to a line 100 ft west of the piers.

Except for Pier 7, which was excavated inside the cofferdam, it was found possible to pre-dredge the remaining pier foundations to a depth of 2 ft below the tremie concrete base, at which elevation a sand and gravel blanket was later placed on the soft bottom inside each cofferdam.

Frames for the cofferdams were supported on twelve permanent foundation H-piles driven in proper position and extending above water to connect to the inside of the frame. After the foundation piles were driven for each pier, the cofferdam sheetpiling was driven, the tremie seal poured, and the twelve so-called pin piles used for initial support of the cofferdam frame were cut off at the top of the seal following unwatering of the cofferdam. Foundation piles were driven with an S-3 McKiernan-Terry hammer to absolute refusal, and about 3 ft into the soft top surface of sandstone and limestone. The minimum number of blows calculated for the pile load for these conditions was ten per inch.

Tremie concrete in general was placed in 6-ft lifts, progressing from one end of the cofferdam to the other, returning after completion of each lift to the first end to start the next lift. A diver was in attendance at all times to check the bottom of the excavation and the movement of the tremie concrete during the placing of the seal.

A temporary timber catwalk, 5 ft in width and supported on timber piles, was constructed by the contractor along the west side of the existing Edison Bridge piers to extend from the south shore to the main channel. This catwalk was used to carry air and water lines and for survey purposes.

The concrete columns for the pier frame are of vertical stepped design, which permitted substantial reuse of

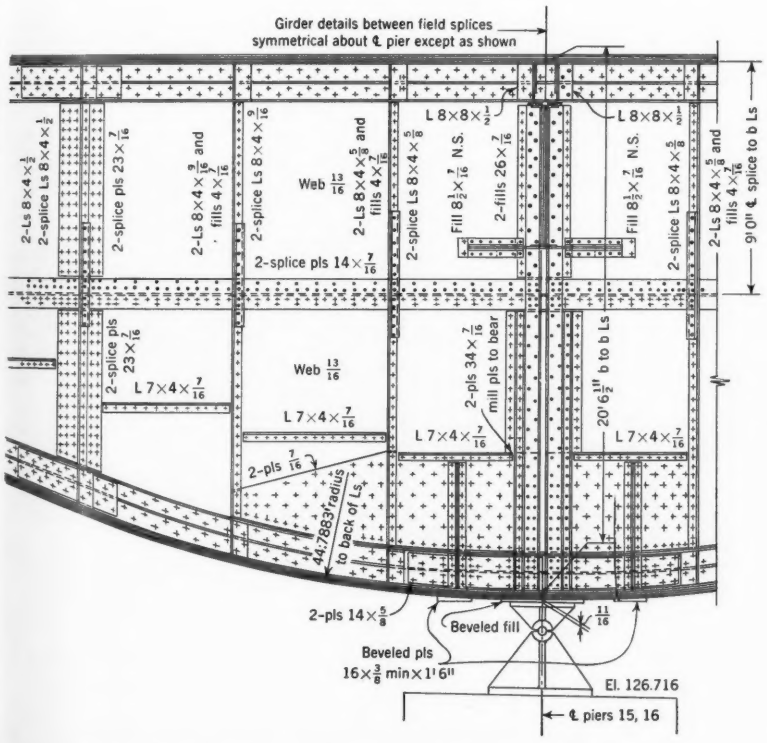
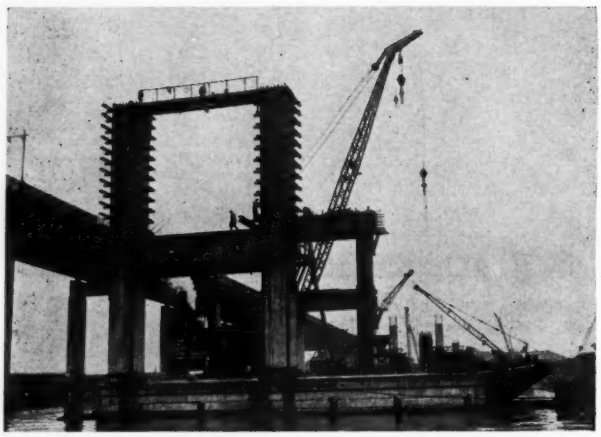


FIG. 2. Plate girders 650 ft long have maximum depth of 20 ft 6½ in. at channel piers. Girders are continuous over three spans. In photo at left, these giant girders are being assembled in Pottstown Works of Bethlehem Steel Co.



Concrete columns for pier frame are of vertical stepped design, permitting substantial reuse of forms. Columns vary in height above pier haft from 31 to 119 ft.

Form work for concrete deck was of maximum simplicity since open steel curbs and steel sidewalk grating confined concreting to roadway slabs only. Panel forms were of plywood, but little reuse was possible because of rapid construction schedule.

forms. These columns vary in height above the pier shaft from 31 ft to 119 ft.

Erection without falsework

A crane operating on the ground erected the six 84.5-ft simple spans adjacent to the north abutment. The first 132.5-ft span at the south abutment was also erected with a crane. This crane then erected, on the first span, a stiff-leg traveler derrick which was used for the erection of the next seven 132.5-ft simple spans. Steel was delivered by land and moved to the pick-up point on a temporary road on the west side of the structure, except for the eighth 132.5-ft span, which was delivered by water.

Girders for the six 152.5-ft simple spans were delivered by water and transferred upland on a temporary track laid along the east side of the structure Steel for these spans was erected by a second traveler derrick operating on the roadway stringers. All simple-span girders, including the 152.5-ft spans, were fabricated and shipped without field splices, and erection was accomplished without temporary lateral reinforcing of flanges.

Field splices for the 650-ft continuous girders were arranged for shipping in lengths of 137.5 ft and 125 ft, while those for the 600-ft continuous girders were for shipping lengths of 137.5 ft, 106 ft, and 113 ft. The erection scheme developed by Bethlehem Steel Company required that certain field splices of the continuous girders be riveted on the carfloats, so that pieces having a maximum length of 263 ft and a maximum weight of 200 tons were erected without the use of falsework. These pieces were lifted at one end by the deck traveler and at the other end by a derrick boat having a 105-ft tower to support the derrick.

The top flange of these long girders was temporarily stayed against buckling by stiffening trusses 11 ft deep, which made up in units 25 ft long, spliced together and bolted to lie horizontally on top of the girder cover plates. The stiffening trusses were composed of structural angles throughout.

Because the bearings on both the intermediate piers of all continuous girder units are of the fixed type, provision was made for jacking the top bearing with respect to the girder to permit placing of bolts between girder flange and bearing. At the time of erection, however, temperature conditions were normal and no jacking was required for any of the three units.

Simple form work for deck

Form work for the concrete deck was of maximum simplicity since the use of open steel curbs and steel sidewalk grating confined concreting to the roadway slabs only. Panel forms were of plywood, but little reuse was possible because of the rapid construction schedule. Reinforcing steel for the 7-in. slab was detailed without bends to provide equal reinforcing at top and bottom.

Finishing of the concrete slab was accomplished as specified, by a transverse screeding machine, a longitudinal float, a 10-ft scraping straight-edge, web burlap drag, and broom finish. The screed was of the portable vibratory type having a bearing surface 6 in. wide and weighing about 700 lb. The screed was equipped with four roller wheels running downgrade on top of the metal curbs, and was hand pulled over the concrete. For curing, a colorless membrane, having a disappearing tell-tale color, was used.

Fire damage to north fender

On June 1, 1954, while riveting of the steel superstructure was being completed and concreting of the deck was well advanced, a fire completely destroyed the creosoted timber fender at the north side of the channel, severely damaged granite on the south face of the adjacent pier of the Raritan River Bridge, and produced spalling of concrete on the pier coping and lower part of the columns of the pier. Some damage was done to the concrete and granite of the adjacent Edison Bridge pier. The work of replacing the fender, replacing the granite, and repairing the damaged concrete was completed in February 1955.

Foundation construction was commenced in December 1952 and essentially completed in January 1954. Superstructure erection was begun in November 1953 and completed in June 1954. Work on the concrete deck was started in March 1954 and completed July 15, 1954, to permit opening of the bridge to traffic August 4, 1954. The total cost of the Raritan River Bridge was $9,858,872, including $4,141,676 for foundations, $4,980,858 for the steel superstructure, $608,982 for the concrete deck, and $127,356 for lighting.

The Raritan River Bridge and the Garden State Parkway were constructed by the New Jersey Highway Authority, the members of which are Orrie De Nooyer, Chairman; Bayard L. England, Vice Chairman; and Mrs. Katherine Elkus White. For the Authority, Harold W. Griffin, M. ASCE, is Chief Engineer and Carl J. Teegen is Assistant Chief Engineer. Ransford J. Abbott was formerly Executive Director, and the engineering staff also formerly included Harold W. Giffin, M. ASCE, Chief Engineer; Walter L. Braybrooke, Assistant Chief Engineer (Field); Carl J. Teegan, Assistant Chief Engineer (Office); Morris Goodkind, M. ASCE, Consulting Bridge Engineer; Harry A. Hartman, Construction Engineer; and Charles E. Vanderhoff, Construction Engineer.

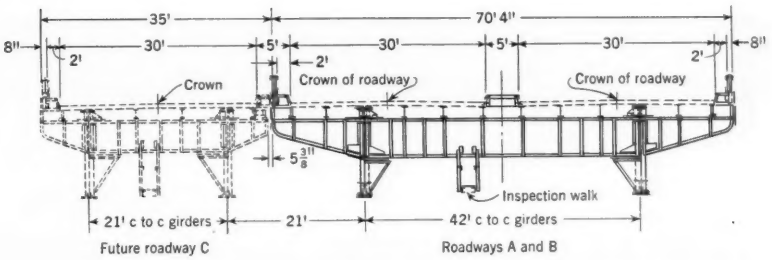


FIG. 3. Typical cross-section for Raritan River Bridge shows two 30-ft roadways initially built and position of future third roadway. Two-column bent is used in present construction, but pier base and shaft are designed to receive third column at a later date.

Parsons, Brinckerhoff, Hall & Macdonald are the general engineering consultants for the Garden State Parkway.

D. B. Steinman, M. ASCE, was consulting engineer on design and supervision of construction of the Raritan River Bridge. For this work, R. M. Boynton was Project Engineer for the substructure; C. H. Gronquist, M. ASCE, was Project Engineer for the superstructure; and John G. O'Donnell was Resident Engineer. Design was under the immediate supervision of Adam Werth for the substructure, A. Zuckerman and I. S. Hansen for the superstructure, and R. Knorr for the lighting system.

The contract for the river piers was awarded to the Frederick Snare Corporation; land piers to Poirier & McLane; steel superstructure to Bethlehem Steel Company; concrete deck to Brookfield Construction Co., Inc., New York; and lighting to the Peifer Electric Co., Inc., Trenton, N.J.

A tense moment is recorded as cranes get ready to position one of largest girders fabricated in United States. Girder 245 ft long, and weighing 188 tons, was hoisted and placed without mishap in 4½ hours.

Compaction control solves heaving clay problem

LAWRENCE A. DuBOSE, A.M. ASCE

Assistant Research Engineer, Texas Engineering Experiment Station

Texas A. & M. College System, College Station, Tex.

When constructed over certain expansive clays, buildings and highway pavements are frequently uplifted several inches in a few years' time. An example of this heaving was reported by Raymond F. Dawson, M. ASCE, who measured vertical movements of over 2 in. in three years for a group of Texas houses ("The Design of Building Footings on Expansive Clay Soils," Reprint No. 17, The University of Texas Bureau of Engineering Research, Austin, Tex., 1953). Vertical movements of 7 to 8 cm in three years were likewise measured by J. E. Jennings for a group of South African houses ("The Heaving of Buildings on Desiccated Clay Soils," Third International Conference on Soil Mechanics and Foundation Engineering, pp. 390–396, 1953).

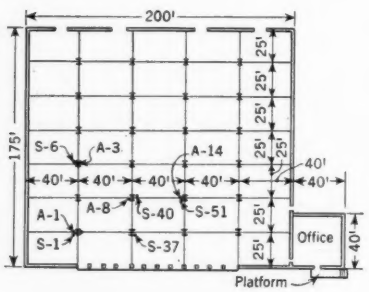


FIG. 1. Floor plan of Schuhmacher Warehouse, Bryan, Tex., shows locations of anchor bolts (A) and slab corners (S) used as reference points in settlement study.

The possibility that such heaving would occur was considered in the design of the concrete floor slab for a wholesale grocery warehouse in Bryan, Tex., designed by William E. Nash, architect, for the Schuhmacher Co. The warehouse dimensions are 175 × 200 ft, and the finished floor slab was laid on a fill from 3 to 5 ft deep to raise it to a height convenient for loading trucks. Available at the site was a sufficient quantity of expansive clay to complete the fill. The question was whether to use this material or to pay the additional cost of hauling in a more select fill material.

In a previous study on another troublesome Texas clay, volume changes had been measured for specimens compacted to optimum conditions. The compaction efforts used varied from the standard Proctor to the modified Army method. This laboratory research had established a fairly well defined relationship between degree of compaction and

FIG. 2. Typical time-movement data for anchor bolts indicate maximum settlement of less than 1/4 in., probably attributable to normal leveling errors.

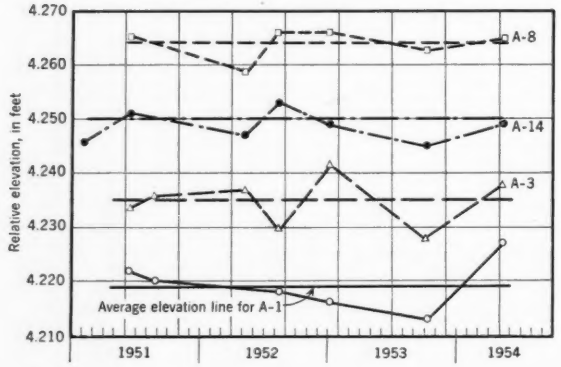
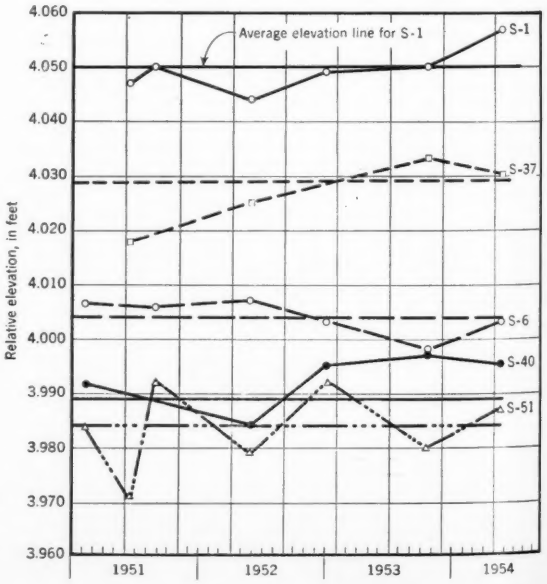


FIG. 3. Typical time-movement data for slab corners also show settlements of less than 1/4 in. Some variation may have been due to varying loads of foodstuffs in warehouse.



percentage of swell (Lawrence A. DuBose, "Evaluating Taylor Marl Clay for Improved Use in Subgrades," Research Report No. 35, Texas Engineering Experiment Station, College Station, Tex., March 1952). Thus, on the basis of the above mentioned study, it was reasoned that by proper compaction control for the warehouse fill, the swelling of the clay and the accompanying slab movements could be reduced within tolerable limits.

Representative samples taken from the borrow site were found to have the following properties:

Property	Sample A	Sample B
Liquid limit, percent	47	58
Plasticity index, percent	27	31
Natural water content, percent	17.5	22
Optimum water content, percent	19	26
Optimum density, lb per cu ft	102	94

The compaction effort used was the standard Proctor (ASTM Designation, D698-42T). The swell and strength characteristics for soil compacted with the above effort were both checked. The percentage of swell under a unit load of $^1/_4$ tons per sq ft was less than 2 percent, and the unconfined compression strength was within the limits required by the floor loadings.

On the basis of the test data, 5,000 cu yd of fill were placed in the summer of 1951, and compaction was controlled by field density checks. Before the concrete was poured, a number of inches of fill sand was placed over the clay, and the slab was then poured in 25 × 40-ft sections.

In the construction of the building, under-reamed footings had previously been drilled to a depth of about 20 ft. Wide-flange columns secured by two anchor bolts supported the roof load. The column and footing arrangement was able to move independently of the slab. This was an ideal situation, since movement could be observed both of a concrete slab on a compacted fill and of footings founded to a depth of 20 ft.

The warehouse floor plan and the locations for anchor bolts and slab corners are shown in Fig. 1. (Only the reference points included in this report are shown in Fig. 1.) At each interior column location, six reference points were possible—2 anchor bolts for the column and 4 slab corners adjacent to the column. Using a benchmark set to a depth of 20 ft, the reference points were checked several times a year. The small variations between successive checks indicated that more frequent leveling was not necessary.

Typical time-versus-movement curves for both anchor bolts and slab corners are shown in Figs. 2 and 3 respectively. In each instance the variations with respect to a mean line are of such an order of magnitude as to be almost entirely attributable to normal errors in differential leveling. In the case of the slab-corner records, a certain amount of variation could have resulted from changes in the unit loads of foodstuffs. For example, at one time an area might be loaded with canned goods stacked 8 or 10 ft high. The next time levels were taken, this load may have been removed or replaced with lightweight breakfast cereals.

On the basis of these data, there is no evidence that either the slab or the deep footings have been affected by heaving or consolidation. Comparing the maximum possible movements of less than $^1/_4$ in. in these observations with values of 2 and 3 in. for a comparable period of time as reported by Dawson and Jennings, it is felt that compaction control was responsible for the present behavior of this fill.

Efficiencies of friction-pile groups found by nomograph

GLEN V. BERG, A.M. ASCE

Research Associate, Engineering Research Institute
University of Michigan, Ann Arbor, Mich.

Of the various means for estimating the efficiency of a friction pile group, perhaps the most widely used is the Converse-Labarre formula:

$$E = 1 - \phi \frac{(N-1)M + (M-1)N}{90MN}$$

in which

E = efficiency of a pile in the group, relative to its single pile value
N = number of piles in each row
M = number of rows in the group
ϕ = arc tan D/S, in degrees
D = pile diameter
S = pile spacing

The nomograph, a device too often overlooked by the engineer, provides a means for obtaining a quick graphical solution, and is especially advantageous here, for it takes all variables into account in a single chart. Such a nomograph is presented in Fig. 1.

To illustrate the use of the chart, assume for example a group of twelve piles, arranged in three rows of four piles, and having a ratio of diameter to spacing of 0.25. First draw a line (shown dashed in Fig. 1) connecting $M = 3$ and $N = 4$ on the vertical scales. Parallel to this draw a second line through $D/S = 0.25$ on the inclined scale. This line (also shown dashed) intersects the left vertical scale at $E = 0.78$, which is the value sought.

A discussion of the behavior of friction-pile groups and curves for use with the Converse-Labarre formula has been presented previously by Irving B. Rau in the July 1954 issue of CIVIL ENGINEERING.

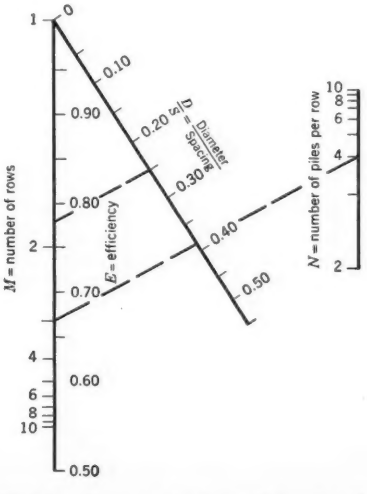


FIG. 1. Nomograph gives efficiencies of pile groups, based on Converse-Labarre formula.

THE READERS WRITE

Why move the Engineering Societies Headquarters out of New York?

TO THE EDITOR: Having been a member of ASCE for over 50 years, a member of its Board of Direction, President of UET, Member of Engineering Foundation, and President of ECPD, I believe I am warranted in expressing the following strong convictions about the much discussed proposal to move the permanent headquarters of the engineering societies to some other city than New York.

During my term as President of UET (1945–1947) I directed a searching study to determine what if anything could be done with the present Engineering Societies Building to meet the growing needs of the engineering societies. The study anticipated what current studies seem to indicate—that the present building is nearly 100 percent obsolete as an engineering societies headquarters. Therefore it is obvious that a new headquarters building is needed. No one quarrels with this fact.

Two questions must be answered, however:

1. What type of building should be designed and built?
2. Where should it be built?

Question 1 is essentially a matter of detail, and needs but little discussion at this time. Question 2 is the guts of the whole problem. To me the recent discussions in CIVIL ENGINEERING, in other engineering magazines, and in the daily press serve only to befog the main issue by such minutiae as building efficiency, cost of land, cost of building, method of financing, raising of funds, and data on how many engineers live within a certain radius of various cities. The main issue is, What is the *ideal* location for the headquarters of the American engineering profession?

Isn't it probably a fact that a great majority of engineers, particularly the deans and nestors of the profession, would in their inner souls prefer to have their own offices in New York? Isn't New York currently building more office buildings proportionately than any other American city? Isn't it because its business leaders and financiers are satisfied that its future is secure, and that, incredible as it may seem superficially, New York is still in its infancy as a world capital? Isn't that the place for our engineering headquarters?

The more than 250,000 engineers in America—over 180,000 of them in the Founder Societies—*can* arrange the financing of a new building if it is properly located. It is nonsense to say that a suitable site cannot be found and a proper building financed on Manhattan Island.

Before going off the deep end and locating in some place other than New York, we should have the confidential signed opinion of the 783 living past officers and past directors of each of the engineering societies involved. These men have in most cases each had several years' experience actively in society affairs, in addition to their somewhat brief term as director, vice president or president. The fact that the majority of such men would be out of touch with the heterogeneous minutiae which have been in the front seats of this discussion so far would be a real blessing. These men would look at the problem of the *ideal* location for society headquarters broadly, and not with any penny wise and pound-foolish consideration of what's got to be done tomorrow instead of what should be done for the long pull. These men are the elder statesmen of the engineering profession. The opinion of such a group would be worth its weight in gold to the boards of directors of the societies.

First, our profession must decide what to do, and second, find a way to do it.

Let the statesmen of the profession decide what to do; let the engineers decide how to do it.

JOHN P. H. PERRY, M. ASCE
Vice President
U.S. Lift Slab Corp.
New York, N.Y.

Professional recognition solves problem of unionism

TO THE EDITOR: Dean Freund (author of the article, "Employers, Ethics, and Young Engineers," in the January issue) and others troubled by the lack of professional consciousness on the part of young engineers, should make a pilgrimage to Salina, Kans., and get acquainted with a firm that has the answer to that problem.

Not long ago, I had occasion to visit the offices of the Wilson Engineering Company of that city. What I saw there makes a bright spot in the all-too-drab picture of employer-employee relations in the engineering profession. In the reception room of this firm, the most conspicuous feature was a long line of engineers' and architects' licenses, framed and conspicuously posted. From head of the firm to latest recruit, the licenses were there as a testimonial to the standing of the firm and a recognition of the professional status of the men who do the work.

That was only the outward display. The real recognition came to light later. In the drafting room I noticed the seals of three different Licensed Professional Engineers on one sheet of plans. The section chief, noting my interest, said "That's the way we do it here. If one of the young men comes up with a solution of any problem that is practical, we use it. He goes ahead and works it out, and when the plans are finished, every man who contributed to the design puts his seal on each sheet that he worked on. We figure that if he contributed the idea, he is entitled to the recognition."

Young men not yet licensed are encouraged to look forward to the day when they will be putting *their* seals on sheets of finished plans. No one needs to worry about the peril of unionism in that office. It does not exist, and it will not exist in the office of any other employer who will treat his professional employees like professional men.

HAROLD H. MUNGER, M. ASCE
Assoc. Prof. of Applied Mechanics
Kansas State College
Manhattan, Kans.

Deflections with varying moment of inertia

TO THE EDITOR: It came as a pleasant surprise to learn that it is customary for contributors to be given five extra copies of any issue containing their work. My five copies of the February issue arrived a day or two after my regular copy.

There are two small errors in my article, "Deflections with Varying Moment of Inertia," as it appeared in that issue. On page 65, the third column, the seventh line from the bottom should read "loading girders" instead of "trucks"—strictly speaking, "between the loading girders and the center line (Fig. 1)." Also, there should be an arrow-head at the vertex of the curve in Fig. 1.

ALFRED GORDON, A.M. ASCE
St. Lawrence Seaway Authority

Montreal, Canada

Galvanized wires advised for prestressed concrete

TO THE EDITOR: In his letter, "Why Prestress New Steel Members," in the January issue, Donovan H. Lee makes a good point when he criticizes the use of uncoated wires of 0.276-in. diameter. We in the United States have a standard product which offers an even better solution than the uncoated bars he recommends. Strands made of hot-dipped galvanized wires have been used on suspension bridges since the latter part of the nineteenth century. The galvanizing gives complete protection and requires practically no maintenance.

In the past few years these galvanized bridge strands have been adapted to prestressed concrete by the development of threaded end connections so that they can be easily tensioned on the job. The strand and its threaded fitting are practically fatigue proof. The most severe test known to the writer consisted of 3,000,000 complete cycles of loading between the design stress (120,000 psi) and the maximum possible stress under live loading (126,700 psi) plus an additional 2,000,000 cycles between 120,000 psi and 133,000 psi. There were no indications of damage at this point, and when loaded statically, the strand failed at the same load as an unfatigued piece. The writer knows of no failures of such a strand due to fatigue loading either in service or under test. The test data reported in CIVIL ENGINEERING for April 1952 (p. 30) demonstrate that high tensile bars cannot match strands in this field.

H. KENT PRESTON, A.M. ASCE
Engineer, Construction Materials Div.
John A. Roebling's Sons Corp.

Trenton, N.J.

Engineering should *not* be taught backward

TO THE EDITOR: The article by Prof. J. B. Wilbur, "Is engineering being taught backward?" in the January issue, is thought-provoking, but the ideas it puts forward are in my opinion dangerous to the standards of engineering education and cannot be left unchallenged.

There is nothing new in the proposed method of teaching engineering in the inverted way by introducing science through engineering problems. This method is already used in technical institutes which have no university status, in technical and vocational schools, and in all other educational institutions which have as their object the training of technicians, works supervisors, etc., as opposed to university trained graduate engineers.

The standard of training in such schools and the quality of their product may be very high, and the men trained in this way do attain very good professional standing and sometimes better remuneration than graduate engineers. However, that kind of training will never provide the qualities required of an engineer, and will never give an adequate scientific foundation for the engineer's work. The result of such inverted training always is that the man so trained knows all the *how's* but will never know enough of the *why's*. He is also not fitted to attack any problems with which he is not familiar. Such training is entirely unsuitable for men who are expected to carry forward development work and provide leadership for the profession.

Engineering is being taught the right way now. First come the basic sciences—mathematics (which should include descriptive geometry), chemistry, physics, and natural sciences plus humanities. Then these sciences, together with advanced mathematics, are applied to engineering problems, and then further applications are made to design and solutions of engineering problems.

Without a solid foundation of first pure and then applied sciences, we shall not get scientifically minded engineers, and we shall not get men who are able to attack and solve new problems, and to utilize the advances continually being made in scientific fields.

There is room for achieving efficiency through changes in methods of teaching, but never anything so drastic and so detrimental, as regards the attainment of our objectives, as proposed by Professor Wilbur. We must strive to improve present standards and adapt them to changing conditions, but let us teach engineering the right way, that is to say, let us build on the foundation of the pure sciences and not the backward way.

S. J. MAZUR
Assoc. Prof. of Civil Eng.
Nova Scotia Technical College

Halifax, N. S.

Limitations on design based on ultimate strength

TO THE EDITOR: The article, "Can Design Be Based on Ultimate Strength?" by Robert L. Ketter and Bruno Thürlimann in the January issue, was a concise and informative presentation of the fundamentals of design for ultimate capacity. The discussion of the design of redundant structures would, however, have been more complete if certain limitations of the technique had been noted.

Among these are, briefly:

1. The very simple analysis permitted by the introduction of the known flow moment at the points of maximum moment is not valid for moving loads. When loads may assume any position, a complete conventional analysis is required before the ultimate capacity can be determined.

2. In those cases where the capacity is obtainable directly from the known position of the yield hinges, the computation provides no information pertinent to the distribution of moments, shears, and deflections under working loads.

3. In steel, economy of design is largely limited to the case of simple rolled sections. Wherever it is intended to use cover plates or variable depth, the resistance of the member at the various critical sections may be adjusted, without significant increase in cost, to provide virtually full efficiency of material.

WALTER E. O'LEARY, J.M. ASCE
Structional Engineer
Hardesty & Hanover

New York, N.Y.

Information on helio-designed houses desired

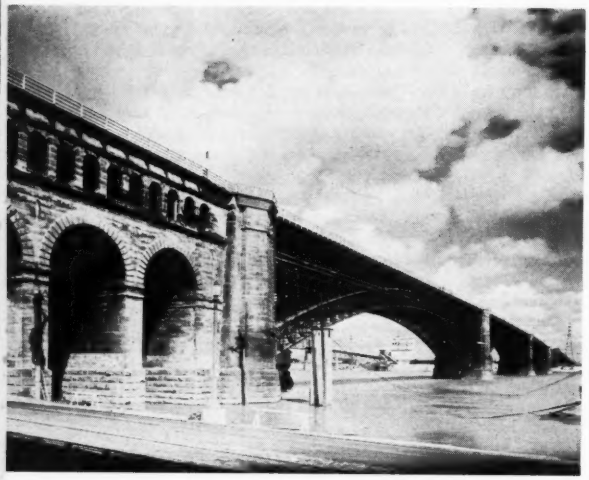
TO THE EDITOR: We are interested in acquiring information pertaining to helio-designed houses which revolve according to the position of the sun. Perhaps some of your readers will have information on this subject. Also, we would appreciate being sent a reprint of any article describing houses of this type which may have appeared in the literature.

R. WARREN CASSELL
Sales Promotion Manager
Gale Dorothea Mechanisms

39-39 63rd Street
Woodside, L.I., N.Y.

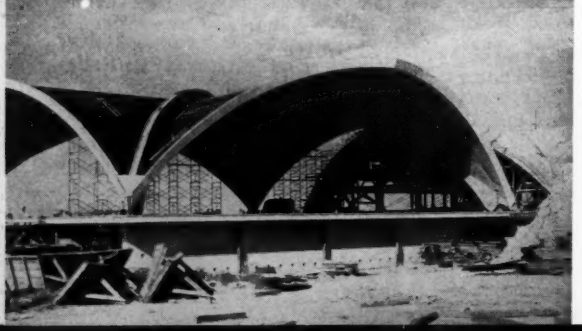
SOCIETY NEWS

ST. LOUIS HOST TO CONVENTION JUNE 13–17



Famous Eads Bridge across the Mississippi at St. Louis is an engineering landmark. Opened in 1874, it made first extensive use of steel and alloy steel in America and first use of pneumatic caisson work in bridge building.

Chain of Rocks Canal and Locks at Granite City, Ill., near St. Louis, has the largest main lock in the Mississippi River system, with a length of 1,200 ft and width of 110 ft.



St. Louis airport terminal building, under construction at the municipal airport, is a notable example of thin shell construction. Its three concrete shells are 120 ft square and 32 ft high.

With " 'Meet Me in St. Louis,' June 14–17," as its theme, the St. Louis Section is making arrangements for the Society's forthcoming Convention in keeping with the city's traditions of hospitality. The full program of professional, technical, and social activities will be printed in the May issue.

Hoover Commission Report

Featured in the notable program will be a discussion of the report and recommendations of the Task Force Committee on Water Resources and Power of the Hoover Commission on Organization of the Executive Branch of the Government. The findings of the committee are expected to be of such general interest that Wednesday afternoon, June 15, will be devoted exclusively to them. Admiral Ben Moreell, Honorary Member of the Society and chairman of the Task Force, will lead the discussion, with the assistance of his coworkers including the four Task Force chairmen: John Jirgal, Chicago specialist in utility economics and finance; Leslie A. Miller, former governor of Wyoming; W. W. Horner, Past-President of ASCE and St. Louis consultant; and Carey H. Brown, manager of Engineering and Manufacturing Services, Kodak Park Works, Eastman Kodak Company. Administrator Charles D. Curran will also take part in the discussion.

The group will present a summary of the organization, work and conclusions of the Task Force and its subsidiary groups on Power Generation and Distribution, Reclamation and Water Supply, Flood Control and Navigation, and will point the way towards implementation of the Hoover Commission's recommendations to Congress. Because of the timeliness of this discussion, some two weeks after the Commission's report will have been made public, invitations to the Wednesday afternoon session have been sent to the

membership of the St. Louis Chamber of Commerce and other interested groups.

On Wednesday morning, following a brief business session, the Committee on Conditions of Practice will conduct a session that will be of general interest to the Society membership.

Varied Technical Program

The Technical Divisions will sponsor some twenty sessions, starting Tuesday morning and ending Friday noon. The scope and variety of this program will assure something of interest for everyone. Some of the sessions will present new information on important research and development projects at such locations as the St. Anthony Falls Hydraulic Laboratory, the Colorado College of Agriculture and Mechanics, and the Research Laboratory of the Association of American Railroads in Chicago.

Geographically, the papers will range from the planning of a water supply and sewerage system for Karachi, Pakistan, to be presented at a session of the City Planning Division, to a paper on "Model Tests, Analytical Computations, and Observations of an Arch Dam," prepared by four staff members of the Laboratorio Nacional de Engenharia Civil, Lisbon, Portugal. There will be papers on the design and construction of important engineering works such as the Arnold Engineering Development Center at Tullahoma, Tenn., and other papers dealing with today's obsessing problems of toll roads and interstate highways. As might be expected, a number of talks will place emphasis on Midwest projects.

Luncheons and Tours

Special luncheons are scheduled each day of Convention week: on Tuesday, under the sponsorship of the Waterways, Hydraulics, and Soil Mechanics and Foundations Divisions; on Thursday, under the sponsorship of the Highway Division; and on Friday, under the sponsorship of the recently organized Pipeline Committee of the Construction Division. Prominent speakers have been obtained for each of these occasions, and the general membership luncheon on Wednesday will be addressed by Raymond R. Tucker, a professional engineer as well as mayor of St. Louis.

A number of tours to points of interest in the area have been arranged. These include a trip through the Aeronautical Chart and Information Center of the U.S. Air Force, and inspection of the Chain of Rocks Canal, Locks and Harbor Project on the Mississippi.

Old-Time Melodrama on the Program

You will cheer the hero and hiss the villain at the authentic melodrama with which you will be entertained after dinner Thursday. Arrangements have been made to transform the comfortable Gold Room of the headquarters hotel, the Jefferson, into a Mississippi River Showboat, and a troupe of actors from the "Goldenrod," last of the old-time showboats, will present one of their classics in true river style. A cocktail party will precede dinner. For Wednesday evening tickets will be available for the internationally famous St. Louis Municipal Opera and for the National League night baseball game.

Ladies' Entertainment Planned

"Be sure to bring the ladies," say the ladies of the St. Louis Section who are planning a fine program for their guests, too. Each day's activities will begin with a coffee hour. There will be tours to a number of the city's historic spots, celebrated local gardens, and Forest Park with its art museum and zoo, where the famous troupe of chimpanzees will put on their usual entertainment. Despite a full schedule of activities, including luncheons at hotels and country clubs, there will be time for shopping and loafing, too.

Make Your Reservations Early

Convention headquarters will be the air-conditioned Hotel Jefferson, St. Louis' largest downtown hotel, where all the technical meetings and much of the entertainment will take place. Though a large block of rooms has been reserved, these will be assigned on a first-come, first-served basis. Requests for reservations should be addressed to Mr. Joseph B. Brooks, Chairman, ASCE Hotel Committee, Hotel Jefferson, 415 North Twelfth Blvd., St. Louis 1, Mo.

ASCE Committee Surveys Construction Industry

A study to determine the position of civil engineers in the management of contractor organizations has just been initiated by the Survey Committee of the ASCE Construction Division. The results of the first questionnaire show that an average of fifteen civil engineers play a dominant role in the operations of typical contractor firms.

The three-page questionnaire sent to the Engineered Construction Mail Forum, a representative group of Society members in 400 construction organizations, elicited a 25 percent response, providing a valid cross section of all Mail Forum members. In-place volume of respondents' organizations, in one or more of twelve construction categories, ranged from $2,000,000 to over $32,000,000 annually, with work on buildings and bridge substructures placing highest. All construction activity of the 97 reporting companies had an annual volume in excess of $1,900,000,000.

A large majority (79 percent) of the respondents indicate that the prime contractor has most influence in the specification of equipment. Another group (15 percent) sees the subcontractor as having the most influence. Opinion is almost equally divided in the remaining group of respondents (6 percent) between the awarding agency and the awarding agency's consulting engineer.

Answers to a question concerning civil engineers in executive positions indicate that civil engineers do hold positions of executive responsibility in contracting organizations.

Other facts revealed by this first study of the Construction Division Committee are that:

1. Construction contracting is an important segment of the ASCE sphere of activity as evidenced by the approximately $2 billion in-place volume of their organizations as reported by 97 civil engineers.

2. There is practically no construction equipment that the civil engineer does not use on one or more types of construction projects.

3. Civil engineers are highly brand conscious and have definite brand preferences for virtually every type of construction equipment.

More Societies Join EJC

Engineers Joint Council has announced the election of the American Society of Refrigerating Engineers (with 6,241 members) to constituent membership, and of the American Institute of Industrial Engineers (with 3,000 members) as an associate. The latter organization is the first to become an EJC associate. Leon Buehler is president of the American Society of Refrigerating Engineers, which has its headquarters at 234 Fifth Avenue, New York City. The Institute of Industrial Engineers is at 145 North High Street, Columbus, Ohio. E. J. Malcolm is its president.

EJC now includes ten societies with a total membership of more than 196,000 members. Its other organizations are the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the American Water Works Association, the Society of Naval Architects and Marine Engineers, and the American Society for Engineering Education.

Is Our Professional Status Threatened?

A panel of Junior Members, composed of Louis F. Butz, Arthur C. Gooch, Thomas P. Wootton, and James J. O'Brien, presented to the Sacramento Section on December 14, the collective opinion of the Section's Junior Forum as to whether civil engineering is a profession or a trade. Because of the interest developed among the members, the talks are here summarized.

"Civil Engineering—Profession or Trade?" When the subject was announced in the Junior Forum of the Sacramento Section, several different viewpoints were expressed. There was a group that violently objected to use of the word "trade" in connection with civil engineering; there was a group that thought civil engineering is or should be a trade; and there was a group which asked, "What difference does it make?" As long as there is a sizable number in the last two groups we feel that there is a possibility that civil engineering will become a trade—a threat to our professional status.

Today, then, the engineer faces the challenge, "Is civil engineering to continue as a profession or will it become a trade?" We believe that civil engineering is most certainly a profession. The position of the civil engineer is an enviable one—the result of an intensified and highly successful struggle by our predecessors in the engineering profession. But we are not satisfied.

For the past year, our Junior Forum has been discussing the problems which we feel threaten the position of the civil engineer today, problems which, if ignored, could easily undermine our professional position. There are three closely related problems which pose the most serious threats.

Professional Responsibilities

The first problem is the lack of awareness on the part of engineers of their responsibilities to their profession and to society. Why is it that engineers persist in the practice of asking for and submitting bids for their engineering services? Why is it that there are so many civil engineers who do not belong to ASCE, and that so many who do belong refuse to take an active part in its activities? Why is it that engineers do not hold more of the responsible positions in the community?

There is but one answer to these questions. Most engineers do not know what their responsibilities are. The engineer is content to consider himself as just another working man rather than as a unique individual with special responsibilities. This can be attributed to the fact that more and more of our engineering works are being conceived in, and executed from, mammoth engineering offices, offices in which the individual engineer is just another cog in the machine.

We cannot hope to grow in professional stature until the engineer and the public are made to realize just what the engineer is, what he does, and what his responsibilities are. All too often the public conception of an engineer is obtained from the movies—a handsome devil six feet six inches tall, parading through the jungle with a transit on one arm and a beautiful native girl on the other.

Our definition of professional consciousness is an awareness of one's responsibilities both to the public and to the engineering profession. The public should be better informed as to the requirements necessary for becoming an engineer. The public should be made aware of the fact that an engineer's education must continue long after graduation, and that licensing as a registered engineer comes only after years of experience and hours of exhaustive examinations. Let people know what type of work engineers do.

Also, there is a need to reestablish the word "engineer" in its true meaning. A good example of this need was recently seen in a local newspaper advertisement—"Buy a power lawn mover—be a *front yard engineer*." The engineer who is aware of his professional responsibilities will adhere strictly to the Code of Ethics by refusing to engage in selfish public criticism of other engineers' work. All of us owe it to our community, to our profession, and to ourselves to take an active part in the solution of community problems.

Broader Education

Related to professional responsibilities is the second problem, the need for improvement in engineering education. This matter has received a great deal of attention from engineers, and rightly so. Despite the tremendous advance made in educational techniques, the engineering student does not have sufficient time to devote to the study of nontechnical subjects. This is because the technical education of engineers has been geared to keep pace with the fabulous growth of engineering knowledge. As more and more technical courses are included in the curriculum, engineering students are becoming less and less well informed in the humanities and the liberal arts. Our Junior Forum is concerned that our engineering schools have not directed their efforts toward the development of a better engineer, more favorably adapted to finding his proper place in society, but rather toward the development of a better technician.

A large majority of the practicing engineers of today are trying to gain better backgrounds in speech, philosophy, and public relations. They will be among the first to state that had this background been provided in school, the time spent to obtain it would have been more than justified. We feel that engineering schools should adopt a five-year curriculum in order to allow more time for the humanities and the liberal arts, for preparing the engineer for useful citizenship, and for enabling him to function more competently in the economic, social, and cultural phases of his work.

Engineering Unity?

The third problem is the lack of engineering unity. Can any one individual or group speak for the entire engineering profession? If not, why not? There is only one answer to this problem. Most previous attempts at forming unity organizations have failed through a lack of backing by individual engineers. Too many engineers will not support an organization unless it has immediate and recognizable personal benefits to offer them.

The ASCE has long been aware of the need for a unified engineering profession and has been active with other engineering societies in an attempt to unify engineers. In 1952 the Engineering Societies Exploratory Group, composed of representatives of 15 national engineering societies, recommended that the engineers of the United States form a unity organization, using the Engineers Joint Council, as constituted in 1952, as the foundation and basic pattern for the new national organization.

Before engineering can become recognized as the truly great profession that it is, attention must be focused on the fact that engineering, as a profession, is not limited by the boundaries of any one branch of engineering, but rather encompasses the broad range of activities embraced by all fields of engineering practice. Through the unification of all branches of

our profession, through a unity organization, we have a definite and practical way of achieving nationwide recognition of engineering as a learned profession. Such an organization, the EJC, is already partially in existence, but the only way that such an organization can become effective is through a subscribing membership. We need a national society of dues-paying engineers which will represent the whole profession and help all engineers to obtain professional and economic recognition.

Our Society has long recognized these problems and has made continuing attempts to solve them. One of the important things that has been done is the establishment of a Code of Ethics and a Code of Practice. More recently ASCE has established the Department of Conditions of Practice to coordinate, expand, and increase the activities of the professional aspects of Society service. The committees included in the department are those on Employment Conditions, Engineering Education, Junior Members, Local Sections, Professional Practice, Registration of Engineers, Salaries, and various task committees.

In order that the public may be more fully informed on the activities of the profession, a public relations program has been instituted. This has resulted in greater attention being given in the press and on the air to the Society's conventions and other activities. One project which has resulted in widespread national and local publicity is the selection by Local Sections of their "Seven Engineering Wonders." These Society activities may not pay dividends in dollars and cents every year, but without them ASCE would be merely a club set up for the exchange of technical information.

Economic Status Secondary

Some engineers claim that the profession has a fourth problem which, as they see it, is the only problem of importance—the improvement of the engineer's economic status. We of the Sacramento Junior Forum, although recognizing a need for some adjustments, are against this short-sighted approach. If the only justification for the engineer's dissatisfaction is with his economic status, he becomes little better than a trade union member who has tied his fortunes to the cost-of-living index.

It has been stated that these are not new problems, but problems which have existed for many years and which will solve themselves. We think this is not the case, hence the reasons for some of our proposals. We feel strongly enough about these proposals to do something about them. We believe there are many others who agree and will work toward them too.

Daniel W. Mead Prizes Doubled in Cash Value

Special notices have been mailed to all ASCE Student Chapters announcing a 100 percent increase in the cash value of the Daniel W. Mead Prize for Students. A similar increase is also applicable to the Junior Member award. Specifically, the value of the student prize will now be $50 instead of $25, and the prize for the best Junior Member essay will be $100 instead of $50.

This year both groups are writing on the same subject, with the prizes going for the two best essays on "What Kind of Advertising Should Be Considered as Derogatory to the Engineering Profession?" Papers must be in the hands of the Executive Secretary (33 West 39th Street, New York 18) not later than May 1, and the winners will be announced at the Annual Convention in New York in October.

The importance of the Mead prizes to students and young engineers cannot be overemphasized. The mental discipline required in assembling one's ideas on the professional subject of ethics is a reward in itself for all participants. For the winners, there is national prestige. The 1955 Official Register (page 121) gives the roster of winners for each year since 1940 when the first award was made.

District–Zone Boundaries Unchanged

A very encouraging statistical picture is given in the accompanying tabulation of voting membership in the Society by years since 1940. The Committee on Districts and Zones, reporting at the San Diego Convention, made no request for any changes in boundaries of Districts and Zones, but instead presented this tabulation with the request that it appear in CIVIL ENGINEERING.

It is to be noted that the big jump in voting membership indicated between 1949 and 1950 is due to the fact that in 1950, for the first time, Junior Members had the right to vote. In 1949 there were 8,300 Junior Members not included in this table, which shows only the voting membership in that and prior years. To the 1940 total should be added 4,023 Junior Members, enrolled but not counted in determining representation units.

ASCE MEMBERSHIP TREND according to Districts and Zones

Dist.	Jan. 1 1940	Jan. 1 1941	Jan. 1 1942	Jan. 1 1943	Jan. 1 1944	Jan. 1 1945	Jan. 1 1946	Jan. 1 1947	Jan. 1 1948	Jan. 1 1949*	Jan. 1 1950	Oct. 1 1950	Oct. 1 1951	Oct. 1 1952	Oct. 1 1953	Oct. 1 1954
1	2432	2452	2481	2493	2632	2834	2954	2686	2846	3042	4540	4670	5246	5700	6015	6241
2	654	662	681	711	745	744	717	787	813	838	1365	1462	1623	1740	1801	1865
3	536	528	526	510	500	510	539	557	577	597	868	923	957	1030	1070	1100
4	692	707	710	690	682	665	714	726	735	760	1186	1266	1410	1529	1611	1656
5	830	901	1038	1106	769	778	760	717	798	782	977	1013	1164	1295	1261	1257
6	384	395	387	389	798	808	824	870	918	950	1660	1789	1982	2051	2125	2104
7	565	598	608	637	617	650	688	709	756	806	1560	1695	1888	1968	2018	2089
8	562	573	570	576	605	622	664	682	717	739	1308	1421	1602	1646	1725	1766
9	589	605	613	672	666	692	743	762	811	833	1513	1596	1796	1949	2094	2229
10	779	812	880	924	996	1000	974	1022	1104	1172	1764	1986	2283	2469	2542	2634
11	769	787	823	843	885	946	1017	1094	1181	1264	4316	4630	5068	5347	5603	5803
12	422	450	466	496	526	553	585	649	713	771	1560	1699	1877	1950	1993	2036
13	883	869	870	920	955	1027	1085	1160	1251	1337	....†	....†	....†	....†	....†	....†
14	439	452	493	514	500	531	552	587	649	687	1250	1374	1505	1523	1524	1502
15	737	765	799	856	875	901	932	972	1075	1144	2097	2277	2543	2574	2676	2769
16	632	638	642	639	653	662	723	810	864	916	1742	1935	2138	2157	2192	2158
Zone																
I	3622	3642	3688	3714	3877	4088	4210	4030	4236	4477	6773	7055	7826	8470	8886	9206
II	2685	2815	3015	3109	3245	3251	3272	3335	3555	3664	5587	6054	6839	7344	7539	7651
III	2787	2866	2926	3038	3041	3157	3370	3550	3797	3981	7373	8021	8929	9243	9553	9744
IV	2811	2871	2958	3115	3241	3427	3619	3875	4220	4516	7973	8606	9488	9871	10272	10608
Totals	11905	12194	12587	12976	13404	13923	14471	14790	15808	16638	27706	29736	33082	34928	36250	37209

* Does not include 8,300 Junior Members, not considered in determining representation units.
† District 13 merged with District 11.

E. P. Lange Becomes Secretary of EJC

E. Paul Lange, assistant secretary of Engineers Joint Council since May 1954, has been appointed secretary of the organization. He succeeds Brig. Gen. Stewart E. Reimel, M. ASCE, U. S. Army (Ret.), of Washington, D. C. General Reimel, who is secretary of the EJC Committee on International Relations, assumed on a temporary basis the additional duties of EJC secretary fifteen months ago. A member of the American Institute of Mining and Metallurgical Engineers, Mr. Lange has engaged in mining engineering in Idaho, Alaska and South America and served in World War II in the Army Counter Intelligence Corps. He is a graduate of the University of Washington.

E. P. Lange

Irrigation and Drainage Conference Scheduled

A three-day Irrigation and Drainage Conference will be held at the Albany Hotel, Denver, Colo., September 8–10. The meeting, co-sponsored by the Irrigation and Drainage Division and the Colorado Section, will include two days of technical papers and discussions of subjects pertaining to irrigation and drainage engineering. A field trip over the Colorado-Big Thompson Project, a spectacular and fully operating multiple-purpose project, is also being planned.

Dean H. T. Person is arranging the technical program, and S. Mark Davidson is chairman of the Committee on General Arrangements.

Restoration of Separate Professional Classification Studied

Several Local Sections have expressed their desire in resolution form that the Board of Direction exercise its influence toward revision of the Federal Civil Service Classification System. The change would provide for the establishment of a group of positions restricted to members of the learned professions, including the practice of engineering (qualification for the latter to consist of graduation from an accredited college, or possession of a current certificate establishing the right to practice the profession of engineering) and toward the revision of the system of job analysis and classification to provide for the designation of professional employees as professional employees rather than to classify them with clerical and administrative personnel. Before 1949, Federal Civil Service employees were classified under "P" (professional), "SP" (sub-professional), and "CAF" (clerical, administrative and fiscal). In 1949 these groups were placed under a single heading known as "GS" (general service).

Several Sections of ASCE now have voiced disapproval of the 1949 change. They believe that the "GS" system fails to give the engineering, medical, and legal professions in the federal service the recognition and distinction they deserve by virtue of their attainments; that the classifications are generally made by non-engineers who lack professional background to properly grade professionals; and that the present "GS" classification system is detrimental to the efficiency of the operations of government.

Early in December the Executive Committee of the Board of Direction requested Vice-President Frank L. Weaver with J. H. Ehlers, ASCE Field Representative, both of Washington, D.C., to study and report on the merits of the expressed desires of these Sections. The study included interviews with United States Civil Service staff members, who are members of ASCE, and study of relatively voluminous correspondence and reports from them and from members of ASCE's Committee on Salaries.

The findings of Mr. Weaver's report are summarized as follows:

1. An act of Congress is required to make a change.
2. Various federal departments and the District of Columbia section supported the present legislation when adopted in 1949.
3. Great care is reported taken by the Civil Service Commission staff in classifying professional positions, and in determining qualifications of candidates for professional positions.
4. Actual titles of positions are much more meaningful identifications of a position than a "P" symbol alone would be.
5. Members of the legal and medical professions in federal service are reported to have made no similar representation of dissatisfaction.
6. Any change made necessarily would have to be considered from the standpoint of all professional groups, as well as of other engineers than civils.
7. Professional persons are reported as not making good position classifiers, in part due to unwillingness of competent professional persons to accept the grade and pay of most position classifiers.
8. The Commission's five years of experience with the "GS" system has demonstrated to the Commission that it is basically sound.
9. The Civil Service Commission probably would not give serious consideration toward any present effort to restore the "P" system of classification of grades.

After giving detailed consideration to the report, the Board concluded at its San Diego meeting that representation to the Congress and to the Federal Civil Service Commission for a change would likely be unproductive at this time.

Coming Events

Metropolitan—Meeting in the Third Floor Auditorium of the Engineering Societies Building, 33 West 39th Street, April 20, at 7 p.m.

Mid-South—Spring meeting at the Hotel Vicksburg, Vicksburg, Miss., April 14 and 15, with the Vicksburg Branch as host. Evening meetings of the Little Rock Branch at Granoff's Restaurant, Little Rock, on the third Wednesday of the month.

New Mexico—Spring meeting at A. & M. College, April 15 and 16. Program will include a visit to the White Sands Proving Ground on April 16.

Philadelphia—Meeting at the Philadelphia Engineers Club on April 12, at 7:30 p.m. (dinner at 6:30), with the Trenton Engineers Club and the American Welding Society as guests. Spring social afternoon and evening at the Bala Golf Club on May 10. Annual Junior Forum field trip on Saturday, April 23.

Texas—Spring meeting at Corpus Christi, Tex., April 28–30, with the Corpus Christi Branch as host.

Wisconsin—Joint meeting with the Wisconsin Society of Professional Engineers on April 28, consisting of an afternoon tour through the U. S. Forest Products Laboratory at Madison, and dinner and a meeting in the University of Wisconsin Union Building.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

The **Arizona Section** has been active in a joint effort of the engineers of the state to keep Senate Bill 54, recently introduced in the Arizona Senate, from being enacted into law. The bill proposes creation of the position of State Highway Director, who would be the chief executive and administrative officer of the Highway Department. Qualifications listed for this top post include a thorough knowledge of modern business methods but omit any mention of engineering training or experience. Vic Householder is chairman of the Section's Legislative Committee.

A panorama on aviation—from the days of the Wright brothers to the near future with its predicted use of atomic power for aircraft, commercial travel at 1,500 mph, and possible space flight—highlighted the February meeting of the **Central Illinois Section.** Dr. Leslie A. Bryan was the guest speaker.

Students put on the program at the annual joint meeting of the **Cincinnati Section** and the University of Cincinnati Student Chapter, held at the university on February 2. Speakers were Chapter President Don Croll, who discussed "Student Chapter Activities"; Phil Borgo, whose subject was "Copper Mining Activities in the West"; and Don McGuire, who discussed the "Romance of Coal Mining" from the vantage point of ten years' experience in the field. Recently elected officers, who will take over Section duties at the close of the May meeting, are George Kral, president; Cornelius Wandmacher, vice-president; and Ray Raneri, secretary-treasurer.

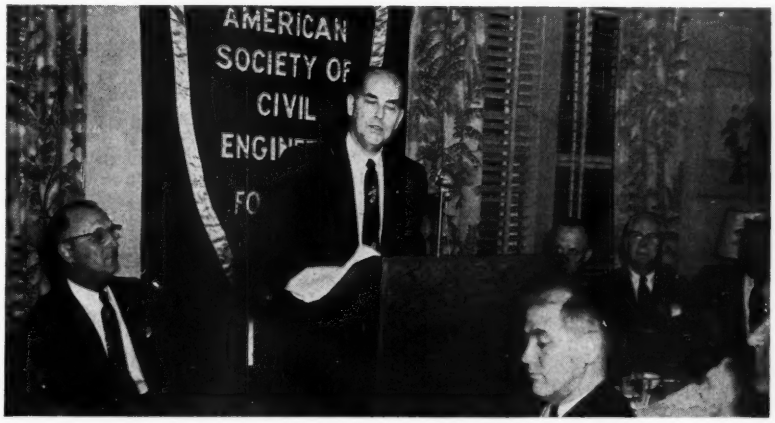
The pros and cons of collective bargaining were up for discussion at the February 18 meeting of the **Cleveland Section,** with Charles Yoder, chairman of the Society's Committee on Employment Conditions, covering the grievances and responsibilities of engineers, both as employees and employers, in the featured talk. He noted that poor employment conditions exist, but emphasized that they can be corrected if employers and employees will recognize their responsibilities. "We must start in the local engineering office and in the Local Section group to obtain respect and recognition as professional and pre-professional personnel," Mr. Yoder concluded.

Short-cuts for obtaining reliable information on engineering soils were explained at the February meeting of the **Columbia Section** by James H. McLerran, highway research engineer with the Division of Industrial Research, Washington State Institute of Technology. Proper training, he said, enables soils engineers to solve many problems by correlating and interpreting soil survey maps prepared in nontechnical terms by the U. S. Department of Agriculture, and individual prints from readily available airphoto maps. Glenn W. Holcomb, ASCE Director and chairman of the civil engineering department at Oregon State College, explained proposed changes in present engineering college curricula that will better fit graduates to cope with sociological and nuclear problems. The Priest Rapids Dam Project on the Columbia River west of Hanford may be constructed as two low-head dams rather than one high dam as proposed by the Corps of Engineers, Keith Willey, Western manager of the Harza Engineering Company, said in the leading talk at the March meeting. Foundation investigations at the site, which is in an extensive fault zone, have shown that two dams would be more economical to build than the previously planned high structure.

With the approval of the Board, the **District of Columbia Section** has changed its name to the **National Capital Section,** and from now on its activities will be listed under that head. The Section's March meeting featured the presentation of last year's James Laurie Prize posthumously to Thomas A. Middlebrooks. Mrs. Middlebrooks and their son received the prize. The greetings of the Society were expressed by President Glidden and Executive Secretary Carey, and John Fanning, director of industrial relations in the Office of the Secretary of Defense, was featured speaker with a talk on "The National Reserve Plan."

Formation of a Subsection at Logan was discussed at the **Intermountain Section's** February meeting. The technical program consisted of a talk on prestressed concrete by Allen Flandro, chief engineer of the Utah Sand & Gravel Products Corporation, who also showed a movie of recent Pacific Northwest projects in which the pretensioning system was used.

Dean Francis M. Dawson, ASCE Director for District 16, outlined recent professional activities of the Society at a meeting of the **Iowa Section** held at Des Moines on March 1. The program also featured the presentation of Junior Membership awards to Jack White, of Iowa State College, and Richard Hoover, of the State University of Iowa. Harold E. Eckhoff, resident engineer for Modjeski & Masters, gave an interesting illustrated talk on the new highway bridge at Clinton, Iowa. The ecomonic impact of water resources development was discussed at



Viewed at the speakers' table during joint meeting of the Georgia Section and the Society of American Military Engineers, are (left to right) Section President J. B. Wilson; Brig. Gen. Herbert D. Vogel, chairman of the Tennessee Valley Authority; H. O. Robison (behind the speaker), president of the Atlanta Chapter of SAME; General Beeman, commanding officer of the Atlanta General Depot; Burton Bell, secretary-treasurer of Section; Jack McDonough, executive vice-president of Georgia Power Company and president of the Georgia Chamber of Commerce; and Edgar Harrison (in front of speaker's stand), assistant chief engineer of Georgia Power Company and member of the executive committee of the Power Division. In the featured talk General Vogel said that the "TVA does not seek to expand." He stressed the development of industry in the Tennessee Valley because of the stimulus of cheap power, and said that nearly half the power TVA produces is consumed by the AEC and other government agencies. Section Past-President Warren S. Mann received a medal for an outstanding increase in SAME membership during his presidency of the Atlanta Chapter.

Shown in the lei-decked group at the Hawaii Section's recent third annual conference are (left to right) J. Gardner Bennett, professor of civil engineering at the University of Hawaii; George M. Collins, chairman of the Board of Trustees of the Bishop Estate in Honolulu; William M. Wachter, Section president and dean of the College of Applied Science at the University of Hawaii; and Daniel V. Terrell, immediate Past-President of ASCE and dean of the University of Kentucky College of Engineering, snapped in the act of presenting life membership certificates to Professor Bennett and Mr. Collins. Pictured at the right are Section officers (seated in usual order): Arthur Y. Akinaka, outgoing president; President William M. Wachter; and Francis K. Wai, vice-president. Standing are Franklin Sunn, treasurer, and Donald S. Austin, secretary.

the Section's February meeting, held at Ames, by Brig. Gen. W. E. Potter, division engineer for the Corps of Engineers at Omaha.

Members of the **Ithaca Section** went to Endicott, N.Y., on February 22 for the annual dinner meeting of technical and engineering societies in the southern New York area. There was a turnout of almost 550 to hear guest speaker, Eugene Bordinat, Jr., chief of Lincoln-Mercury styling for the Ford Motor Company, whose topic was "What's Behind the Styling of an Automobile?"

To mark Boy Scout Week the **Kansas City Section** was host to a group of local Scouts at its February 8 dinner meeting. To the pleasure of all, the national sport was highlighted in the featured talk by William C. MacPhail, public relations and promotion director for the Kansas City Athletics. Mr. MacPhail set forth interesting facts concerning the worth of a major league ball club to a typical city, and showed a film consisting of high points in the four 1954 World Series game.

Two recent **Kansas Section** dinner meetings were devoted to the Kansas Turnpike. In Topeka on February 18, Joseph Sorkin, partner in the Kansas City firm of Howard, Needles, Tammen & Bergendoff, spoke on the history and general features of the project. In Wichita on February 25, Bruce Roberts and Elmer Pearse, assistant general manager and bridge design engineer for Wilson & Company, described the engineering of the southern part of the project and the bridges on this section.

New **Louisiana Section** officers are Roy T. Sessums, president; Lee H. Johnson, first vice-president; Calvin T. Watts, second vice-president; B. A. Grehan, secretary-treasurer; and Frank C. Fromherz, assistant secretary-treasurer. Raymond F. Dawson, ASCE Director and Professor of Civil Engineering at the University of Texas, was featured speaker at the February dinner meeting of the Section's **Shreveport Subsection.** Organization and administration of ASCE was his topic.

Engineering aspects of the extensive iron-ore deposits in northeastern Canada were discussed at the January 28 meeting of the **Maine Section's New Hampshire Branch** by Cyrille Dufresne, Canadian geologist and chief of geological exploration for the Iron Ore Company of Canada. Dr. Dufresne dwelt particularly on recent developments in Labrador that have led to the opening of a region which will soon be shipping high-grade ore at the rate of 10,000 tons a year. Over 150 attended the meeting—a joint session with the New Hampshire Society of Engineers and the Green Mountain Branch of ASME.

Scheduled ASCE Conventions

ST. LOUIS CONVENTION
St. Louis, Mo.
Jefferson Hotel
June 13–17, 1955

NEW YORK CONVENTION
New York, N.Y.
Hotel Statler
October 24–28, 1955

DALLAS CONVENTION
Dallas, Tex.
Hotel Baker
February 13–17, 1956

Speakers at recent meetings of the **Little Rock Branch** of the **Mid-South Section** have been Ward Goodman, chief engineer of the Arkansas State Highway Department, and Oren Hayes, who has recently returned from three years in Austria as chief of procurement for the U.S. Forces. New **Vicksburg Branch** officers, elected at a luncheon meeting on January 26, are Harvill E. Weller, president; Guy L. Arbuthnot, Jr., vice-president; and Richard C. Ahlvin, secretary-treasurer. The featured speaker was J. M. Caldwell, of the Beach Erosion Board, who discussed the development and use of echo sounders in connection with hydrographic surveys.

The **Montana Section's Billings Branch** has unanimously endorsed the Governor's Interim Highway Committee's program for raising additional funds for use in improving and extending Montana highways. Speakers at recent Branch meetings have been Jerry B. Dean, president of the Montana branch of Armco Drainage & Metal Products, Inc., and David de L. Condon, chief park naturalist for Yellowstone National Park.

A warning that Russia is outstripping the United States in producing the engineers "both need vitally to guide their technical development" was sounded by Carl Jansen, president of the Dravo Corporation, Pittsburgh, and principal speaker at a recent joint dinner meeting of the **Nashville Section** and seven other professional groups in the area. There was an attendance of 242 at the meeting, the first in a projected annual series of Engineers' Week observances.

New **Nebraska Section** officers, unanimously elected at the January meeting in Omaha, are George R. Bathe, president;

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Asphalt from Standard Oil gets shipped to you direct from the shipping point nearest your job site. Shipments get to the site faster, keep you on schedule.

2

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3

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1 A supplier that delivers according to contract *when needed.* Standard Oil recognizes this as a prime factor in contracting for asphalt, delivering as the contractor needs material.

2 A supplier familiar with the contractor's problems. Standard has been supplying asphalt to contractors in the Midwest for many years. Standard salesmen know contractor's problems . . . know how to give him service.

3 A contractor must have dependable sources of supply. Taking care of its customers through periods of short supply as well as delivering when materials are plentiful is the kind of service contractors need, want and get from Standard. With the big program of road construction now under way and promises of even bigger programs to come, an assured, dependable source of asphalt is a must for every road building contractor.

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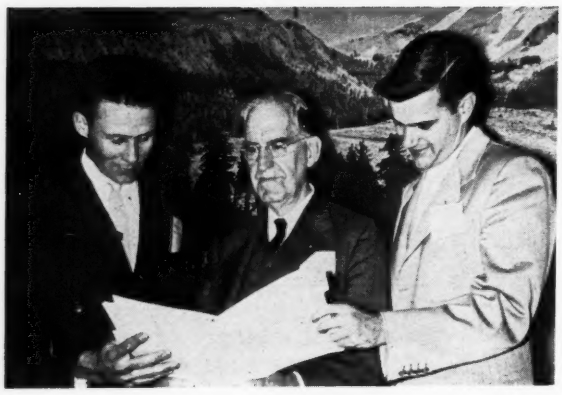


University of California Student Chapter members go over President Glidden's busy itinerary with him during his visit to the San Francisco Section in February. Shown, left to right, are Robert McNeill, President Glidden, and William Blackmer. President Glidden was principal speaker at a meeting attended by over 150.

George C. Ernst, senior vice-president; Harold G. Garner, junior vice-president; and Russell J. Peterson, secretary-treasurer. Later Mr. Garner was obliged to resign because of his transfer to Kansas as district engineer of the Portland Cement Association, and Richard O. Green was appointed junior vice-president in his stead. Structural features of the city's new auditorium were described in the featured talk by guest speaker T. A. Balderson, head of the structural department of the Leo A. Daly Company, Omaha.

Northwestern Section members M. W. Hewitt and Richard Lutz received certificates of life membership at a recent meeting. In the annual election of officers, held the same evening, W. F. Arksey became president; T. W. Thomas, first vice-president; F. W. Thorstenson, second vice-president; and Jesse E. Fant, secretary-treasurer. For their January meeting members toured the University of Minnesota experimental engineering laboratories after briefing by university staff members—Professors Lorenz Straub, George Schroepfer, Paul Andersen, Miles Kersten, and T. W. Thomas.

Various phases of soil mechanics were studied at the February 10 meeting of the **Oregon Section.** William C. Hill, state soils engineer, read a paper on the practical application of sand drain principles to embankment foundations, and Roy C. Edgerton, state research engineer, discussed the use of radioactive isotopes in measuring moisture and soil density and demonstrated the equipment used in the method.

The **Philadelphia Section's Junior Forum** is off to another good year. Heard at its recent monthly meetings were Carroll Taylor, bridge designer with Richardson & Gordon, whose talk dealt with problems involved in the construction of highway plate-girder bridges, and Maurice Rdesinski, of the Kuljian Corporation, whose topic was "What Effect Will Federal Aid to Engineering Projects Have on Engineers and Engineering?" Members of the Section's **Trenton Branch** were recent guests of the Princeton University Student Chapter. The program highlighted the presentation of life membership certificates to Leon E. Andrews and Philip L. Voss, and a talk by Henry Drudding, resident engineer for the Port of New York Authority, who outlined the scope of the organization's activities.

President Glidden was guest speaker at the **Pittsburgh Section's** annual meeting and banquet, with a well-received talk on the relationship between private engineering practice and public works. At a joint session of the Section and the Engineers Society of Western Pennsylvania Shailer S. Philbrick, district geologist and assistant chief of the Engineering Division of the U. S. Engineer Office at Pittsburgh, showed by means of slides how a knowledge of geology is essential to correct interpretation of core borings. The Section's **Junior Branch** recently sponsored a meeting for the Student Chapters at the University of Pittsburgh and Carnegie Institute of Technology. Students attending report that they gained valuable information from the program put on by the Junior Members and consisting of a symposium on what a young engineer may find himself doing in his first years of employment.

Comparative design values, spans, depths, and loads for ordinary concrete versus those for prestressed concrete formed the subject matter of an interesting talk given at the February 10 meeting of the **Providence Section.** Myle Joseph Holley, Jr., associate professor of structural engineering at MIT, was featured speaker.

Plans for forming a Subsection in the Charleston area were discussed by the **South Carolina Section** at its all-day annual meeting in Columbus on January 21. Officers for 1955, elected during the business meeting, are Ilo A. Trively, president; Charles F. Lynn, vice-president; and Albert E. Johnson, secretary-treasurer. Technical papers presented dealt with the design and manufacture of prestressed concrete cylinder pipe, by R. E. Bald, assistant chief engineer for the Lock Joint Pipe Company, East Orange, N.J.; the St. Lawrence power project, by Truman H. Safford, Southern representative for Chas. T. Main, Inc., at Charlotte, N.C.; and the utilization of plastic materials in pipe applications, by H. D. Woodmansee, Southeastern district manager for the Monsanto Chemical Company at Cincinnati, Ohio. Members of the Citadel and University of South Carolina Student Chapters were guests of the Section.

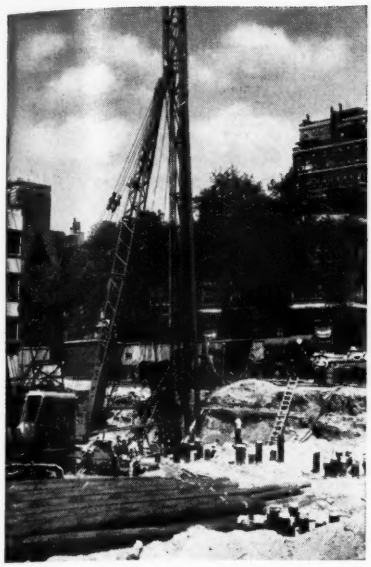
The **Tacoma Section** is completing arrangements to entertain the Pacific Northwest Conference in Tacoma April 22 and 23. With the meeting theme, "Future Highways of the Pacific Northwest," the two technical sessions scheduled for Friday, the 22nd, will feature talks by outstanding authorities on highway financing, right of ways, foundations, and toll roads. Saturday will be given over to a trip by Navy ship to the U. S. Naval Shipyard at Bremerton. That evening there will be a banquet and installation of new conference officers, followed by dancing. The ASCE Executive Committee will meet during the program. Conference headquarters will be the Winthrop Hotel.

For a change of pace the **Fort Worth Branch** of the **Texas Section** scheduled a talk on medical ethics for its February 14 dinner meeting, with Dr. F. B. Gooch, a surgeon, the speaker. Featured speaker at the **San Antonio Branch's** February meeting was Dr. Fred H. Weston, local optometrist and wildlife authority, who described Texas wildlife resources.

"Why don't we learn from history?" asked Joseph Komenyffy, former chief of staff of the Second Hungarian Reserve, in the leading talk at the **Tri-City Section's** dinner meeting on February 22, called to honor George Washington as an engineer and surveyor. Mr. Komenyffy's talk covered the opposing points of view that waring nations express as justification of their *casus belli;* the effect of expanding spheres of influence in trade; and the way seeds of war are sown at peace tables. He expressed the hope that the menace of the A- and H-bombs may restrain us from the horrors of another war. ASCE Director Thomas C. Shedd spoke on recent Society activities at the Section's January meeting.

ASCE MEMBERSHIP AS OF MARCH 9, 1955

Members	8,859
Associate Members	11,358
Junior Members	17,840
Affiliates	70
Honorary Members	42
Total	38,169
(March 9, 1954	37,192)



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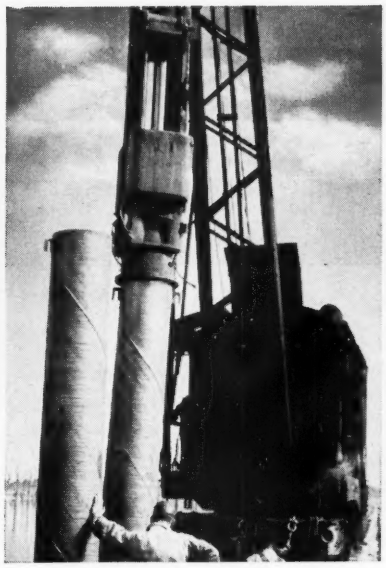
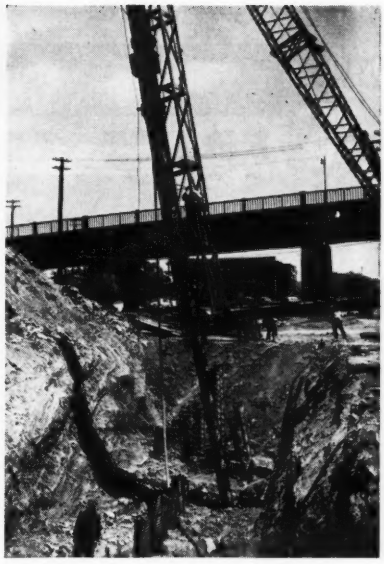


Armco Caissons are being used here in rebuilding old railway bridge.



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	ARMCO CAISSONS	24" to 36"	.375" to .500"	Up to 70 feet
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ARMCO FOUNDATION PIPE

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

More pay for government employees in the Classified Civil Service seems to be reasonably assured as this bill advances minus some of the features which caused a veto in the last session of Congress.

Highway legislation is being critically reviewed in the Senate Public Works Committee where proponents of two rival approaches to the problem of highway development are sparring. The administration bill based on the Clay Committee Report is being strongly supported. Opponents of the credit financing proposed by General Clay would raise the federal gasoline tax to pay for the new highway system. Senator Byrd wants the federal gas tax given to the states; calls the Clay plan "financial legerdemain." ASCE is expected to testify on this legislation.

An "Anti-Government-Competition Act" introduced by Senator McClellan (S. 1003) would reduce government competition with private enterprise. The Commerce Department would hear complaints from businessmen and consult with the proper government officials to limit that competition.

The Davis-Bacon Act would be extended to cover wage rates on many types of construction work not heretofore covered, under bills now before the House Labor Committee (H R. 4566, etc.).

The designation **"professional" employee** under the Wage-Hour Act would be restricted to those receiving over $6,000 a year under a prepared bill introduced by Senator Lehman Also, under a bill introduced by Senator Murray (S.1173), supervisors would be counted as employees under the labor law.

At the annual meeting in March of the American Congress on Surveying and Mapping and the American Society of Photogrammetry **the position of surveying and mapping** in the engineering profession was ably discussed by a panel which included the chairman of the ASCE Surveying and Mapping Division. An ASCE committee is preparing a report on this subject.

ASCE testified before the **Joint Congressional Committee on Atomic Energy,** submitting a resolution on control of atomic wastes. We urged that the responsibilities of the states and the U.S. Public Health Service in controlling disposal of radioactive wastes and in protecting water resources be specifically recognized in the Act and that the Atomic Energy Commission should be authorized to encourage state health departments to assume responsiblity for health and safety aspects of nuclear-energy operations.

Atomic energy problems will be considered at a major Congress on Nuclear Engineering and Science to be held in Cleveland December 12–16, under the sponsorship of Engineers Joint Council.

Engineers and Architects Get Together

The Joint National Cooperative Committee of ASCE and the American Institute of Architects met in Washington on March 14. A new form of contract for use by architects to cover services rendered them by engineering firms was recommended for approval for publication. A corresponding form for the use of engineers engaging the services of architectural firms is expected to be published soon.

Progress on a study of the fees paid by architects to structural engineering firms was discussed.

Legislation

There was an exchange of comments on legislation before the 84th Congress including housing, school and hospital legislation, the Anti-Government-Competition bill, and proposals to redefine a "professional" worker and to extend the Davis-Bacon wage law. The highway bill, various public works proposals, and Social Security legislation were also discussed, so that both AIA and ASCE would know each other's views.

Competitive Bidding

It was ascertained that AIA and ASCE have essentially the same views on competitive bidding for professional engineering services. Recent state court decisions covering the subject were analyzed.

Joint Meetings Urged

It was agreed to recommend that one joint meeting of an ASCE Local Section with the AIA Chapter in the locality be held each year on a topic of mutual interest; likewise, that the Student Chapters located in same city should hold a joint meeting each year.

With the strong encouragement of A/E design contracts by the defense agencies, it becomes increasingly important to consider the relations between architect and engineer and their joint relations with the public.

Exhibit: Engineering in Building Design

Following the meeting a joint reception was held in connection with the opening of a joint exhibition sponsored by the Committee entitled "The Re-Union of Architecture and Engineering." The opening was attended by over 100 government officials, trade association executives and local officers and committeemen of the two societies. It marks the first public event jointly sponsored by the two societies.

The ASCE delegation on this Joint Committee consists of Craig Hazelet, co-chairman, ASCE Vice-President Mason Lockwood as Board contact member, W. Orme Hiltabidle and Joseph H. Ehlers, co-secretary.

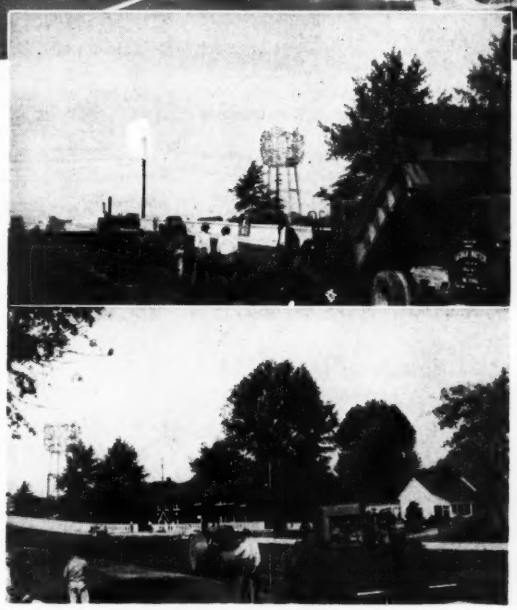
Washington, D.C.
March 24, 1955

A 12-in. Asphalt pavement for Louisville

The U. S. Route 60 by-pass through Louisville, Ky., had one objectionable feature. Its traffic had to pass through a shallow viaduct under the L. & N. Railroad. Last year, the State Highway Department eliminated this bottleneck by constructing an overpass above the tracks, which results in the freer, safer movement of traffic.

An interesting point about the paved approaches to the new overpass was the exclusive use of hot-mix Texaco Asphaltic Concrete for the 9-inch base, the 1½-inch binder course and the 1½-inch wearing surface. This one-foot thickness of resilient, flexible asphalt was especially desirable for this project, because of the sand-gravel fill on which it was laid. Should any subsequent settlement of the fill occur, the asphalt pavement's ability to maintain contact with the fill assures it of complete, permanent support—an important reason for asphalt's greater durability and lower upkeep cost.

Louisville's 12-inch hot-mix asphaltic concrete pavement is one of a number of types of road, street and airport construction, which Texaco Asphalt Cements, Cutback Asphalts and Slow-curing Asphaltic Oils offer the road builder. Helpful information about methods and materials recommended for all of these types is supplied in two free Texaco booklets, which our nearest office will be glad to send you.



Heavy-duty Texaco Asphaltic Concrete pavement, 12 inches thick, constructed by the Kentucky State Highway Department on the US Route 60 by-pass in Louisville.

Contractor: BRESLIN CONSTRUCTION CO., Louisville

THE TEXAS COMPANY, Asphalt Sales Div., 135 E. 42nd Street, New York City 17

Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 2 • Minneapolis 3 • Philadelphia 2 • Richmond 19

TEXACO ASPHALT

NEWS BRIEFS . . .

Improved Highway and Airport Paving Studied at ACI Convention

Various phases of concrete research, design, and construction were explored at the 51st annual convention of the American Concrete Institute, held in Milwaukee, Wis., February 21–24. In addition to the "work sessions" of some twenty technical committees, there were many papers and reports dealing with today's special problems in the field and an interesting manufacturers' exhibit.

With the President's proposed $101 billion road program foremost in engineers' minds, much emphasis was naturally placed on materials and methods for building better pavements. Prestressed concrete pavements were offered as a new solution to both highway problems and airport problems created by the new and heavier aircraft and the heat and blast effect of jet engines. Thomas Cholnoky, J. M. ASCE, structural designer for Frederic R. Harris, Inc., New York, characterized the principal advantages of prestressed concrete as (1) greater load-carrying capacity, and (2) elimination of a great number of expansion and contraction joints, which are needed in conventional concrete pavements. In addition to these basic advantages, Mr. Cholnoky pointed out, prestressing provides a residual compressive energy in pavement, which "will restore continuity of the pavement after any excessive or accidental load or other stress-producing phenomenon introduces stresses exceeding the flexural or tensile strength of the concrete, but not in excess of the ultimate strength of the prestressed section."

Retiring ACI President Charles H. Scholer, M. ASCE (left), congratulates Charles S. Whitney, M. ASCE, on his election to the presidency of the organization.

Other advantages are that concrete pavements with prestressing can be built thinner than comparable slabs without prestressing; the effect of temperature changes will be reduced in such pavements; and the concrete under compression will offer a higher resistance against surface wear and provide a smooth surface without cracks. He emphasized, however, that prestressing will improve highway and airfield pavements "only if it can be accomplished on a competitive level with present conventional practice."

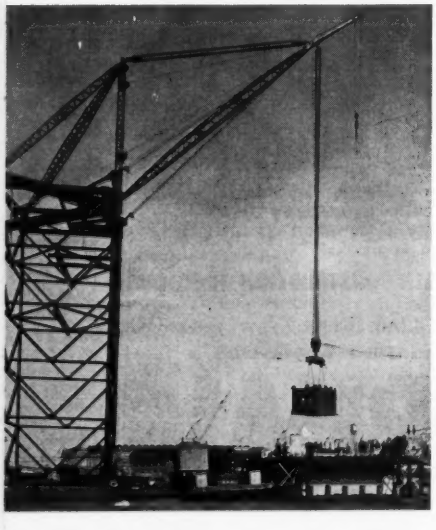
Varied and sometimes unique construction techniques used in modern concrete projects were described in another session that attracted much attention. These techniques include building a roof on the ground and then lifting it into place; combining sliding forms and prestressing to construct a 2,000,000-gal elevated concrete water tank; use of three-dimensional "jigsaw" formwork for shell roofs supported at four points; and use of prepacked concrete for the encasement of penstocks in hydroelectric power plant construction.

Design and construction of the 2,000,000-gal elevated water tank for Dallas, Tex., believed to be one of the largest prestressed concrete tanks ever built, were described by J. J. Closner, vice-president of the Preload Co., Inc., New York, and T. Carlweitz, engineer for B. M. Heede, Inc., New York. The tank, which is 98 ft 6 in. in dia with a wall height of 35 ft, rests on a 2-ft-thick reinforced concrete slab. Four circular, concentric reinforced walls 83 ft high support the tank and slab. Overall height of the structure from footings to the top of the 4-in.-thick concrete dome is 131 ft 6 in.

One of the interesting innovations in the structure is the use of rubber pads under the wall and under the dome ring, which are provided to minimize the restraint at the edge of the wall during the various loading stages. The wall might be described as "floating" on the rubber pad. Hydraulically raised slip or sliding forms erected the 83-ft-high concrete substructure in 126 hours. The lifting rate averaged 8 in. per hour, during which time 11 cu yd of concrete and an average of 1,000 lb of steel were placed.

Charles S. Whitney, M. ASCE, partner in the consulting engineering firm of Ammann & Whitney, New York and Milwaukee, was elected president of the ACI for 1955, succeeding Charles H. Scholer, M. ASCE. Other officers are Walter H. Price, M. ASCE, head of the Bureau of Reclamation's engineering laboratories at Denver, who was elected vice-president for a two-year term, and Frank Kerekes, M. ASCE, dean of the academic program at Michigan College of Mining and Technology, who was elected for a two-year term as vice-president in 1954 and continues in that office.

New honorary members in the organization are Thomas E. Stanton, M. ASCE,

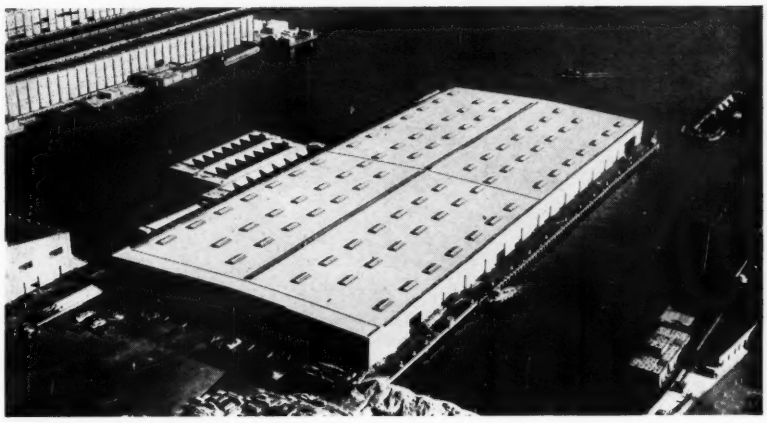


Derrick Boat Speeds Tower Erection for Delaware Bridge

In erecting steel for the towers of the $90,000,000 suspension bridge over the Delaware River between South Philadelphia and Gloucester City, N.J., the Bethlehem Steel Company is using one of the world's largest tower derrick boats. The boat, which has a capacity of 115 tons, is outfitted with a 20-ft extension, so that its tip stands 240 ft above the water (the height of a 22-story building). By means of the boat the sections are lifted into the air and set down on anchor bolts 3 in. in dia. Each leg of the tower will be held fast by 28 anchor bolts. There are ten tier sections in each tower. The Delaware River Port Authority is building the bridge, which will be opened early in 1957.

former materials and research engineer for the California Division of Highways, Sacramento, and Frank H. Jackson, engineering consultant of Washington, D.C. The Henry C. Turner Medal, given "for notable achievements in or services to the concrete industry," was awarded posthumously to Roderick B. Young, who was research consultant for the Hydroelectric Power Commission of Ontario prior to his death last August. Rudolph C. Valore, Jr., received the organization's Wason Medal for "the most meritorious paper" in the 1954 Proceedings, and Thomas B. Kennedy and Katherine Mather were awarded the Wason Medal for "noteworthy research" reported in the ACI Journal.

Large New Pier Begins Operation in Hoboken



Aerial view shows $6,300,000 Pier C in Hoboken built by the Port of New York Authority for occupancy by American Export Lines, Inc., which took over March 1. The 700-ft long by 328-ft wide, single-deck cargo pier is the widest in the Port of New York. Made of steel and concrete on rustproof steel piling driven to solid rock, the structure is fire resistant and features the latest protective devices. Features contributing to efficient operation include 192,440 sq ft of covered space, direct rail track connections, ample truck loading and unloading space, and a continuous loop traffic lane enabling trucks to enter and leave the pier without turning around. An article on the project in the February 1954 issue (page 50) stresses the economy of the prestressed concrete deck. Overall responsibility for the project rests with John M. Kyle, M. ASCE, chief engineer of the Port of New York Authority, and the Port Authority's design staff. Plans were prepared by Parsons, Brinckerhoff, Hall & Macdonald, and construction was handled by J. Rich Steers, Inc.

Turnpike Plans Pushed By Michigan and Texas

Major toll turnpikes ranking with those of the East are being planned by Michigan and Texas. The Michigan Turnpike Authority is putting finishing touches to plans for a 115-mile north-south toll road from a point just south of Saginaw to a point south of Detroit. In Texas a 223-mile road connecting the Dallas-Fort Worth area with Houston and an 83-mile road to connect the southwestern outskirts of Dallas with Waco are being financed by bond issue. A 167-mile extension southwestward from Waco to San Antonio will be built later.

The $186,000,000 Michigan turnpike will provide a major feed line into and out of the states most heavily industrialized area, and speed commuter traffic in the densely populated areas around Detroit, Dearborn, Pontiac, and Flint. According to E. Thomas Baker, chief engineer of the Michigan Turnpike Authority, final engineering and revenue reports on the north-south toll road will be ready in a few weeks. Barring legal difficulties, construction will begin next year, and the road will be opened to traffic early in 1958. Present plans do not call for a connection with the Ohio Turnpike because of key arteries already in use between Detroit and Toledo. However, the state legislature has authorized the Turnpike Authority to construct a four-lane expressway between the two states when it is considered financially feasible.

The huge Texas road-building program is taking shape under three separate road-building authorities. Two of these—the Sam Houston Turnpike Corporation and the Texas Turnpike Company—are private, non-profit organizations. The third, the recently created Texas Turnpike Authority, is an agency of the state government. Ground-breaking ceremonies for the 83-mile, $46,000,000 Dallas-Waco phase of the Dallas-San Antonio Project took place February 21. Completion in about two years is expected. The Capitol Engineering Corporation are the construction engineers for the Sam Houston Turnpike Corporation, which has been authorized by the legislature to build the Dallas-San Antonio Highway. De Leuw, Cather & Company are the engineers for the Texas Turnpike Company, which will build the 223-mile expressway connecting the Dallas-Fort Worth area with Houston.

These improvements represent the first phases of the state's $500,000,000 toll highway program that may ultimately total 890 miles, extending from the Oklahoma border to the Gulf Coast and linking all the major cities in the state.

Connecticut's Shepaug Dam to Begin Operation

A project for harnessing the Housatonic River will be completed in May when flooding operations for the $10,000,000 Shepaug Dam begin. Located along the river between Southbury and New Milford, the 1412-ft-long dam project will be the largest in the state. The turbine wheel, of the variable-pitch Kaplan type, is believed to be the first of its kind in the country developed for a fall as high as 97 ft. It will have a capacity of 50,000 hp.

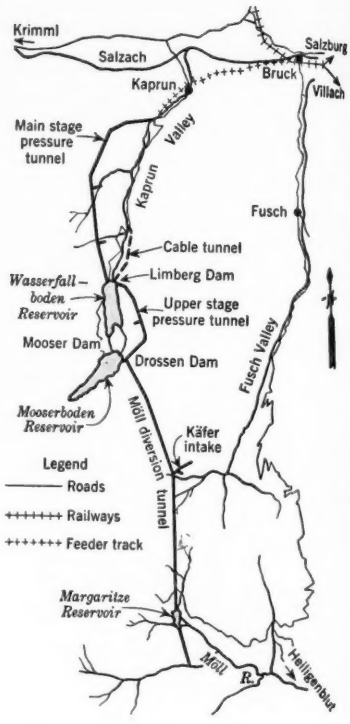
The dam is being built for the Connecticut Light & Power Company by United Engineers, Inc.

N. Y. International Airport to Have New Passenger Terminal

Plans for a $60,000,000 passenger terminal development at New York International Airport are announced by the Port of New York Authority. An innovation in airport design, the development will comprise an eleven-block-long International Arrival Building with two adjacent airline wing buildings, seven individual airline terminal buildings, and roadways, taxiways, aprons and related facilities, all within a 655-acre central landscaped oval. Construction of the development will start this fall, with completion of the International Arrival Building and the two airline wing buildings scheduled for early in 1957.

Wallace K. Harrison, M. ASCE, New York City architect, is design consultant and coordinator of exterior architecture of the various buildings. The Port Authority buildings were designed by Skidmore, Owings and Merrill in collaboration with the Port Authority staff.

Limberg Dam (left), erected to form the Wasserfallboden Reservoir, is 400 ft. high and a key feature in the Kaprun Valley development project. It was completed in 1951.



Austria Develops Kaprun Valley Power

A large-scale project to increase Austria's water supply by developing the hydropower resources of the Kapruner Ache (a tributary of the Salzach River which flows into the Inn) has been intermittently under way for a number of years. In 1938 construction work was begun on a large hydro-power plant in the Kaprun Valley, one generating unit of which was put in operation in 1944. With an output of 45,000 kw, this unit represented only 13 percent of the total capacity of the valley. However, since the close of the war the development of the valley has been pushed with the aid of Marshall Plan Funds.

The development consists of three principal projects—the Main Stage, the Upper Stage, and the Möll River Diversion Scheme.

The Main Stage includes the Wasserfallboden Reservoir, which is built at an elevation of 5,250 ft and has a storage capacity of 70,000 acre-ft; the 400-ft-high Limberg Dam, which impounds the reservoir; a 4.4-mile headwater conduit; the Kaprun power station, built at an elevation of 2,500 ft and with a generating capacity of 220,000 kw; and an outdoors-type switching station. In operation since 1951, the plant has eliminated the outages that had been of frequent occurrence during winter peak power demands.

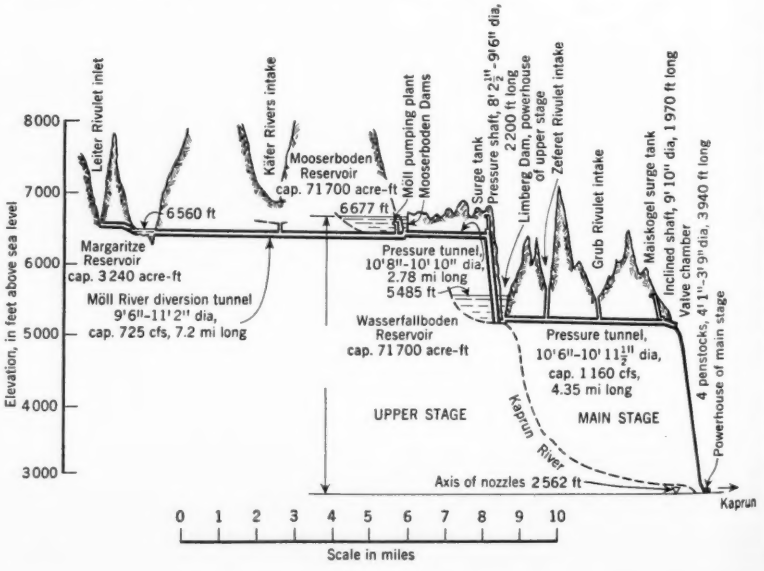
The Upper Stage consists of the Mooserboden Reservoir, at an elevation of 6,560 ft and with a storage capacity of 70,000 acre-ft; a 2.8-mile headwater conduit; and a 112,000-kw generating station erected at the foot of Limberg Dam.

The third phase of the development, the Möll River Diversion Scheme, was required because natural runoff was not sufficient to fill the two reservoirs. Included in this project is the Margaritze Reservoir, which was erected on the southern slope of the Hohe Tauern mountain range at an elevation of 6,560 ft and has a storage capacity of 3,240 acre-ft. Through the Möll Tunnel—7.2 miles long and varying in diameter from 9 ft 7 in. to 11 ft 2 in.—the water is carried from the southern slopes to a pumping plant located near the Mooserboden Reservoir on the northern slopes of the Hohe Tauern. The water may be carried to the reservoir without passing through the pumps when the reservoir is at low level, or pumped into the reservoir when the water level is high. It may also be conveyed directly to the reservoir of the main stage.

When completed in 1956, the power plant development will have an installed capacity of 320,000 kw, which, if the pumping plant is utilized, will produce 815,000,000 kwhr.

Information on the Kaprun Valley Project was supplied by Dr. Erwin Königshofer, engineer for the Osterreichische Elektrizitatswirtschafts-Aktiengesellschaft, Vienna, Austria.

Shown below is a general profile of the entire Kaprun Valley power plant group. Salient installations in the project are indicated on the map (above).



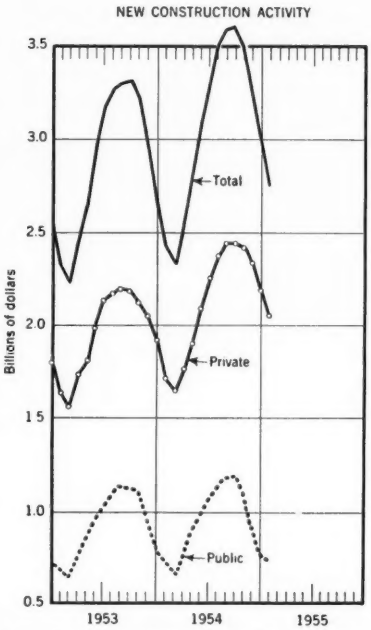
New Construction Activity at Record February High

Despite a seasonal decline in new construction activity in February, the $2.6 billion of work put in place was 12 percent above the previous February high of last year and set a new record for the month. In a joint announcement, the Secretaries of Labor and Commerce said outlays for the month were at an annual rate of over $40½ billion, compared with the $37.2 billion spent last year.

Spending for private industrial buildings, as well as for warehouses and office-type structures, declined less than usual during the month, while work put in place on stores and other mercantile buildings rose contrary to seasonal expectations. Highway construction and conservation and development work declined more than usual because of an abnormal amount of inclement weather. Most other major construction categories showed the usual January-February change.

During the first two months of 1955, expenditures for all new construction totaled $5.4 billion. This was about 13 percent above last year's volume for the same months, and an all-time high for the January-February period, even after adjustment for price changes.

A shift occurred between 1954 and 1955 in the importance of the various types of construction under way during the first two months of each year. For example, a major upswing of 36 percent in private residential building more than compensated for a 42 percent drop in public industrial building, which resulted largely from a decrease in work at Atomic Energy Commission sites.



February expenditures for new construction, at $2.6 billion, set a new record for the month, despite the usual seasonal decline.

Church construction and commercial building also rose substantially over January and February of last year (30 and 20 percent, respectively). Schools (private and public), recreational buildings, and military facilities were up by more than 10 percent; sewer and water installations and hospitals (private and public) were moderately higher; and new private industrial building was up slightly.

Public utilities maintained a slight edge over 1954, as a 19 percent decline in railroad construction was more than offset by increases in other types of utilities. The only other major categories to show decreases were conservation and development work, public housing, and farm construction. The level of highway construction was the same this year as last, even though the winter of 1955 has been much more severe than that of 1954.

Thus far in 1955, expenditures for all types of new private construction totaled $4.05 billion—21 percent above last year's total for the same period. Outlays for new public construction, at $1.38 billion, trailed the 1954 figure by 5 percent.

Construction Named by AGC as America's Greatest Industry

The week-long 36th annual convention of the Associated General Contractors of America (AGC), held at the Roosevelt Hotel in New Orleans, March 14–18, was devoted to the serious business of construction, which has become the nation's greatest single industrial development, and to less-serious interludes of golf, banquets, and a boat trip on the Mississippi along the New Orleans waterfront. AGC President John MacLeod, of the Macco Construction Company, pointed out that "the total volume of construction will account for about one dollar in each seven spent in the nation for goods and services, and for about 15 percent of the jobs for the gainfully employed."

A Big Highway Program

President Eisenhower's $101 billion ten-year highway program was to the fore in convention deliberations. Robert F. McKennon, governor of Louisiana, told the contractors that the Governor's Conference, of which he is chairman, has recommended a plan that was substantially followed in the President's highway message of February 21. If Congress passes the Gore Bill, he said, it "won't get the job done." The Gore Bill would authorize a federal appropriation of $1.6 billion annually for five years under a state-federal matching formula. Discussing the financing of the program, he declared, "every dollar of road taxes ought to go to highways." The $2.4 billion annual revenue from federal highway user taxes should, by congressional action, be put into construction of the 40,000-mile interstate highway system. As to how the program should be carried out, he strongly emphasized that "We don't need government construction of roads or a federal agency to do the job."

The convention passed a resolution in favor of carrying out this part of the program through the Bureau of Public Roads and the various state highway departments as at present. AGC President-elect George C. Koss, M. ASCE, told the Senate Subcommittee on Roads on February 28 that the contracting industry "has the capacity to carry out a greatly expanded highway program promptly, efficiently, economically, and in such a manner that the public will receive increasing value for its investment in highway construction." Highway contractors could increase their present capacity fourfold in five years, "if they knew that a continuing program would be carried out."

Short Supply of Highway Engineers

"One of the problems to be solved before the ten-year enlarged program gets fully under way is engineering," A. B. Clark, deputy commission of engineering and construction for the Bureau of Public Roads, told the Highway Contractors Division. He noted that currently there is a 21-month lag on federal-aid projects between the time that funds are authorized, and the time materials and equipment are actually utilized on the job site. Staff engineers should devote time to shortening this time-lag, he said. A tremendous amount of high-level engineering will be required to start up the program and keep it moving. At this time about 33,000 engineers are employed on highway work amounting in 1954 to $3.1 billion (4.0 billion, including right of ways). About one-fourth of each year's 4,000 graduates in civil engineering will be required to supply the losses in this force. For each added $1 billion of new highway work we will need 4,000 additional civil engineers, which means that "if they were all available to the highway engineering profession, the supply would not be enough for the expansion contemplated." All means of increasing the supply must be used. He said that, "reliance must be placed on attract-

ing older engineers from other industries, on the use of consultants, on increasing salaries of highway engineers to meet those of competitive industries, and in better utilization of engineers now employed on highway work." He suggested that each contractor encourage one college engineering student to get into highway work, "and while you are at it work on two students because you will want one for yourselves."

In an open joint meeting of the AASHO-AGC Committee, the subject of staffing of highway departments came in for vigorous discussion. In commenting on upgrading graduate engineers, it was pointed out that "we seldom go wrong in giving greater responsibility to young engineers; we should get the most out of each man's skill." Several AGC chapters are giving college scholarships in highway engineering.

Convinced that it is not necessary for all draftsmen and surveyors to have a diploma, Ohio has a program for training several hundred high-school boys each year to do subprofessional work. Michigan has a "six-month work, six-month school" program for highway workers, and other states report similar steps.

It was the consensus of a number of speakers that it is almost certain that the United States will have a greatly accelerated highway program and that, in spite of many problems involved, no survey has revealed any doubt that the program can and will be carried out.

Construction by Contract for Economy

Top-level conferences between AGC committees and high-ranking government officials already have clarified and improved the contract provisions and the specifications under which contract work is being done for government. Rear-Admiral J. R. Perry, chief of the Bureau of Yards and Docks, said the Navy proposes to protect contractors against suffering losses due to "unforeseen government delay." By removing the risk from the contractor there will result a more equitable contract, lower bids from contractors and a direct saving to taxpayers. W. A. Dexheimer, M. ASCE, Commissioner of Reclamation, in reporting the Bureau's reliance on the contract method of construction pointed to the hot Tecolote Tunnel holed through in January as an example of "the ingenuity, resourcefulness, and intestinal fortitude typical of the American contractor." Brig. Gen. D. H. Tulley, Assistant Chief of Engineers for Military Construction, told the Convention, "Today approximately 95 percent of our vast programs, military and civil, is done by contract. We believe that this is the way to do it, both effectively and economically. You have convinced us."

By resolution the convention went on record as opposed to the day-labor method of construction as uneconomical. For public work this method leaves no record of construction costs. Concerning collective bargaining, the convention voted to resist to the fullest extent demands for wage increases to crafts and labor.

World Health Day Features Clean Water

This year World Health Day, April 7, emphasizes the importance of clean water for health. The day is being observed in many countries as the birthday of the World Health Organization, which was established eight years ago. It is particularly intended to arouse a world-wide consciousness of the importance of clean water to man's health.

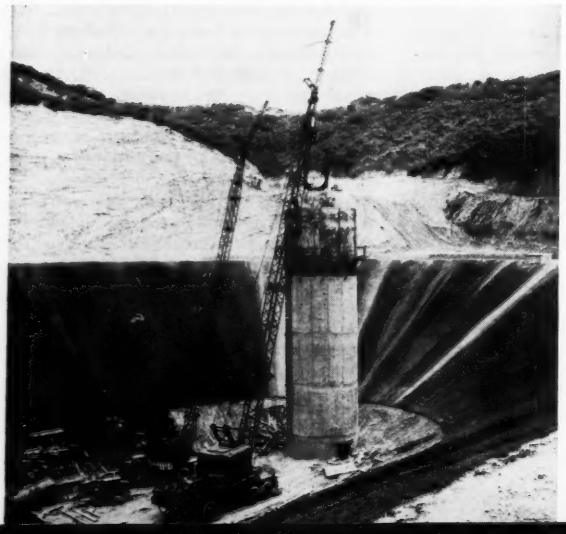
Although water is our most precious national resource, pollution from our fast-growing industries and cities presents a constant threat to our safe use of it. In many countries today water-borne diseases, such as typhoid, cholera, and dysentery account for a high proportion of illnesses. In some countries these diseases are given as major causes of death.

In the United States steady progress has been made over the past century in providing safe drinking water. Our small toll of water-borne diseases is a direct result of the fact that American engineers have provided 17,000 communities with water works serving 105 million people. Engineers have installed 12,000 sewer systems to serve 100 million people, and 7,000 sewage treatment plants to safely dispose of the wastes from a population of 60 million. In spite of these works, our rapid growth in population is developing a backlog of needs for new plants and for replacements. In his economic report to Congress on January 28, President Eisenhower noted that an annual expenditure of $1.2 billion for the next five years will be needed for new water works systems and another $1.8 billion per year for new facilities to treat and dispose of sewage and industrial wastes.

With the accumulated knowledge American engineers have obtained in solving these problems, the United States is in a position through WHO to help organize programs, and advise on improving the public water supplies in less developed countries where help is needed. More directly our Foreign Operation Administration (FOA) assigns American engineers to foreign health ministries under bilateral agreements to provide them with technical guidance for the construction of local water supply and sewage disposal projects. Through FOA, also, training programs for nationals of a country are set up and through fellowships for study in our universities technically competent men are trained to carry on the program when the American engineer advisers return to the United States. WHO has its headquarters in Geneva, Switzerland.

Contract Let for Eight St. Lawrence Turbines

The New York State Power Authority has awarded a $5,051,461 contract for eight hydraulic turbines for the St. Lawrence Power Project to the Allis-Chalmers Manufacturing Company. The units, which will be installed in the Barnhart Island power house, will incorporate latest improvements in turbine design including automatic lubrication systems. Each will be rated at 79,000 hp.



Multi-Level Gating Installed in Eagle Rock Reservoir

Eagle Rock Reservoir, one of many in the Los Angeles water supply system, lies high in the hills back of the city. Here a construction crew lowers into the concrete structure the frame for a 60-in. Rodney Hunt sluice gate, which will cover the opening seen at the bottom of the tower. Other gates, with a total weight of 28,000 lb, lie on the bottom of the reservoir ready for emplacement at different levels on the opposite side of the tower. Multi-level gating permits different strata of water to be drawn—an advantage in keeping water from stagnation in reservoirs not subject to helpful changes of temperature. The reservoir is a project of the Los Angeles Department of Water and Power, of which ASCE Director Samuel B. Morris is chief engineer and general manager.

Dates for U.S. Applied Mechanics Congress Set

To avoid conflicting meeting dates the organizing Committee for the Third U.S. National Congress on Applied Mechanics is making early announcement of the congress, which will be held at Brown University, June 11–14, 1958. Announcements concerning the preparation of papers will be made later. Inquiries may be addressed to Prof. W. Prager, chairman, or Prof. D. C. Drucker, secretary, of the Organizing Committee at Brown University, Providence 12, R.I.

Good Structural Steel Year Forecast

Producers of fabricated structural steel expect their 1955 business to equal if not exceed 1954, according to Earle V. Grover, president of the American Institute of Steel Construction, national trade association for the steel construction industry. In a year-end statement, Mr. Grover said that preliminary reports of the Institute reveal that though the boom no longer exists, 1954 shipments of fabricated structural steel will be the highest since the 1929 peak.

Shipments for 1954 will amount to 3,200,000 tons as compared with 3,117,711 tons in 1953, an increase of nearly 3 percent. Bookings of new business during the year approximated 2,500,000 tons, against 2,786,590 tons in 1953, a decrease of slightly more than 10 percent. The backlog of unfilled orders during the first ten months of 1954 dropped from 1,740,000 to 1,300,000 tons.

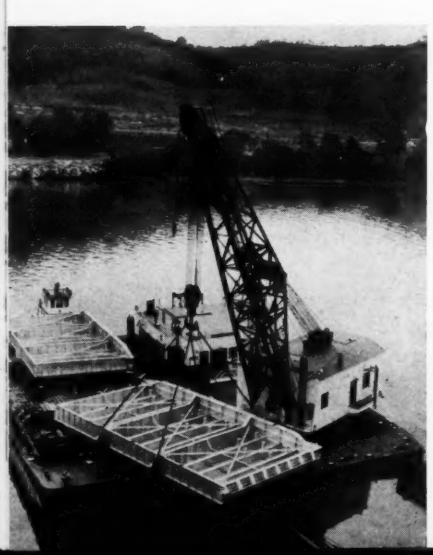
The high level of construction is expected to hold through next year. Tabulations covering only 18 states show contemplated expenditures of $4.5 billion for toll roads alone. Such superhighways require thousands of bridges, overpasses and underpasses, as evidenced by the 282 crossing, all of steel, on the 160-mile Garden State Parkway in New Jersey and the 507 crossings on the 427-mile New York State Thruway.

"A major element in the outlook for 1955," Mr. Grover said, "is the nationwide need for additional classrooms, particularly in secondary schools, which is one phase of construction where steel will be in exceptional demand. Military construction will also specify steel, now that it is readily available." Recent legislation providing for financing and construction of federal buildings under a lease-purchase arrangement will likewise result in considerable activity, according to Mr. Grover.

Improvements Planned For Manhattan Bridge

The John A. Roebling's Sons Corporation, Trenton, N.J., has signed a $2,198,169 contract with New York City for the replacement of important structures on Manhattan Bridge over the East River, according to an announcement from the company. The firm, which is a subsidiary of the Colorado Fuel and Iron Corporation, will furnish all materials and labor necessary for replacing cable bands and suspenders on the bridge. Engineering surveys for the project will start immediately, and the entire job will be completed in 1956.

Connecting Manhattan and Brooklyn, the 46-year-old span is one of the world's most heavily traveled bridges. It has a main span of 1,470 ft, supported from four cables, each 20 3/4 in. in dia.



Tandem Barges Deliver New Mississippi River Lock

New 98-ton miter gate for the upstream end of the main lock at Locks No. 26 on the Mississippi River at Alton, Ill., is lifted aboard tandem barges at the Dravo Corporation's shipyard at Pittsburgh. Each gate leaf, fabricated of welded steel, is 60 1/2 ft long by approximately 30 ft high. Constructed by Dravo for the St. Louis District of the Corps of Engineers, the gate was delivered to St. Louis on the two barges lashed together.

AIEE Nominates President

Morris D. Hooven, of Montclair, N.J., was nominated president of the American Institute of Electrical Engineers at the organization's recent winter meeting in New York. Mr. Hooven, who is an electrical engineer with the Public Service Electric and Gas Company, Newark, N.J., will succeed A.C. Monteith, vice-president of the Westinghouse Electric Corporation, Pittsburgh.

Australia Authorizes Study of Power Needs

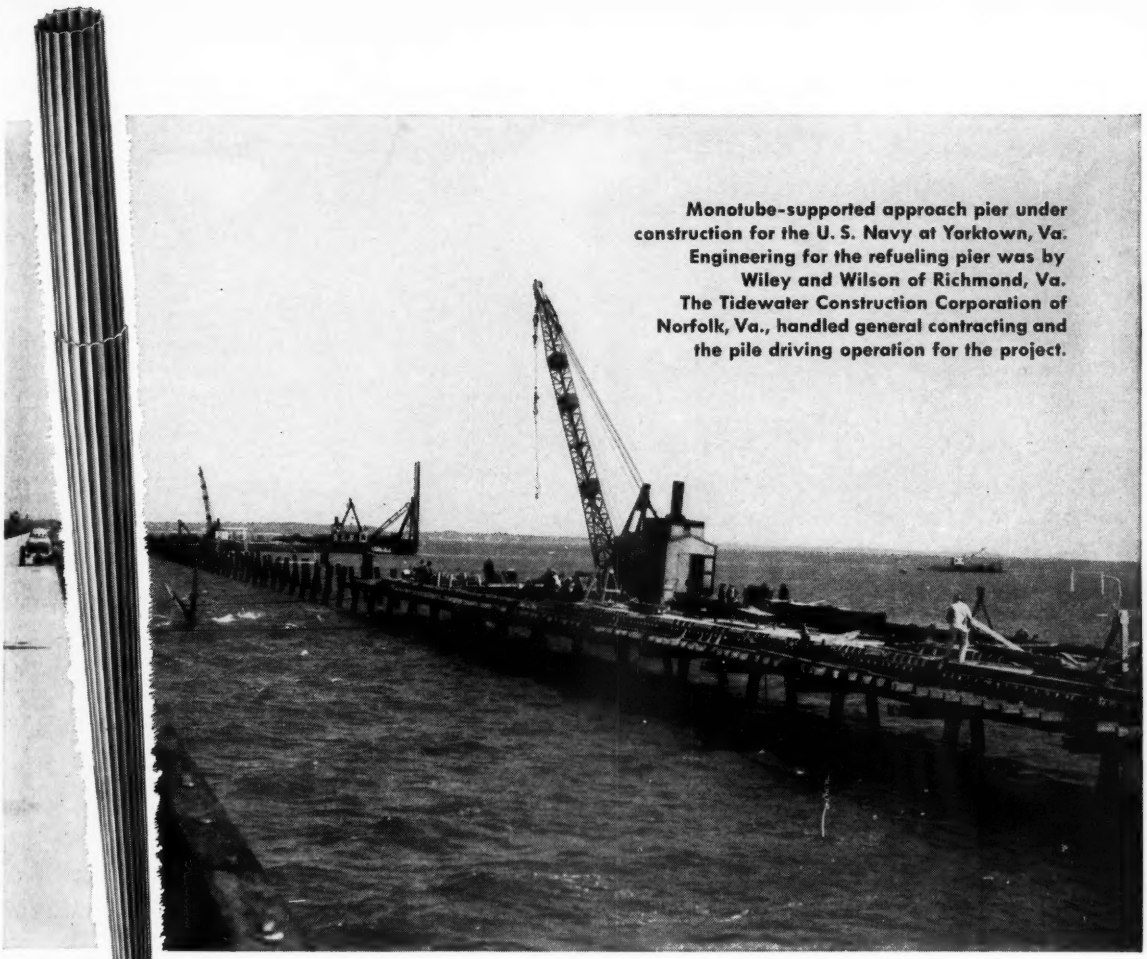
Power problems and costs in connection with the development of large hydroelectric projects in Australia will be analyzed by Ebasco Services Incorporated. The study has been authorized by the Snowy Mountains Authority, an agency of the Australian government, which is in charge of the largest engineering project ever undertaken in Australia and one of the largest works of its kind in the world. Now in construction, the Snowy Mountains Project will supply some 3,000,000 kw of electric power for the states of New South Wales and Victoria.

Ebasco Services has established an office in Sydney, where it will be represented by S.B. Smith, electrical engineer in charge of the field work; L.A. Presby, civil engineer; and D.C. Swift, mechanical engineer.

Movie Shows Crawler Tractor Progress

Release of a 16-mm sound-color documentary film, "The Big Track," is announced by the Caterpillar Tractor Co. The narrator is Walter Cronkite, well known news correspondent and TV personality, who describes the fifty-year history and growth of the crawler tractor with on-the-spot dramatic sequences similar to his TV show "You Are There." The story begins in 1904, with the world's first commercially successful crawler tractor, built by a predecessor company of the Caterpillar Tractor Co., demonstrating on marsh-like farmlands near Stockton, Calif. Another sequence was taken in World War I, which saw the crawler principle applied to "mobile forts," or tanks, for service with the British and French forces. The war assured the success of the tractor because of its ability to keep supplies and ammunition on the move in the sticky mud of No-Man's Land. Authentic newsreels and the company's own library, which dates back to 1911, supply the film footage.

The 28-minute film closes with a look into the future. "The Big Track" was produced by the Calvin Co., of Kansas City, Mo.



Monotube-supported approach pier under construction for the U. S. Navy at Yorktown, Va. Engineering for the refueling pier was by Wiley and Wilson of Richmond, Va. The Tidewater Construction Corporation of Norfolk, Va., handled general contracting and the pile driving operation for the project.

Rigid Cold-Rolled MONOTUBES... ideal choice for pier construction

DURING the recent construction of the U. S. Navy fueling pier at Yorktown, Virginia, Monotube piles proved how easily they can be installed with perfect alignment in approximately 40 feet of water.

766 Monotubes were used in the 3000-foot pier. By means of a simple girt weld, the piles were rapidly extended, *as the driving progressed,* to meet the requirement for 100 to 140-foot completed lengths. Result: faster project completion . . . reduced installation costs!

The cold rolling process of manufacture results in exceptional rigidity and strength to resist the "dead" and high "live" loads to which piers are subjected.

For assistance in solving your foundation problem, write to The Union Metal Manufacturing Company, Canton 5, Ohio. Newly published Catalog No. 81 is now available.

UNION METAL

Monotube Foundation Piles

American Equipment Speeds Highway Work in Brazil

Brazil's expanding highway program opens new horizons to American heavy construction equipment. One of many projects now under construction is Estrade Brazil 57—a 57-mile road being pushed through mountainous terrain to link the Volta Redonda steel mills with the São Paulo-Rio de Janeiro Highway and thence with the industrial centers of the two cities. The new thoroughfare will also serve as an important farm-to-market connection. When completed, it will have two 23-ft traffic lanes and be surfaced with concrete. Photo courtesy of Caterpillar Tractor.

January Housing Starts Set Record for the Month

Though nonfarm housing starts declined slightly (3 percent) in January to 88,000, the number of new dwelling units begun was the highest on record for the month and 33 percent above the January 1954 figure, according to the U. S. Department of Labor.

Privately owned housing starts alone numbered 87,800 in January. On a seasonally adjusted basis, the Bureau of Labor Statistics notes, this represents an annual rate of 1,424,000 starts—slightly under the annual rate for December 1954 (1,473,000), but greater than for any other month since August 1950.

January activity was ahead of December in many parts of the country. The number of new units for which building permits were issued was considerably higher in January than December in the Southern, Southwestern, and Mountain States. This suggests not only a January gain in housing starts for those regions but also continued strength in housing activity during February when many of the units authorized earlier will get started. On the other hand, January permit volume was down substantially in the Northern and Far Western sections of the country where housebuilding activity normally is affected by winter weather.

Public housing authorities began construction of about 200 new units last month, compared with 1,400 in December 1954 and 1,300 in January 1953.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"You look licked," teased Cal Klater.

"I'd say *stumped*, but not licked," replied Joe Kerr.

"So how about that New Years' Resolution to answer every problem in 1955," taunted Cal.

"Oh I have an answer, but I'm still stumped, Mr. Smarty. I'm stumped by the valentine exchange. Christmas presents were easy. Since each boy gave a 10-ct present to each younger boy, there were $\frac{1}{2}b(b-1)$. Likewise for the girls, and if all cost between $200 and $300,

$$4000 < b(b-1) + g(g-1) < 6000 \quad (1)$$

which I fiddled to find $b+g$ between 64 and 110.

"But those valentines! Each boy sent one to each younger girl and each girl one to each younger boy, but nary a clue as to who's older than who! If the boys were all older than girls, or the girls all older than boys, the number of valentines is simply bg, and either unlikely event gives,

$$2000 < bg < 3000 \quad . \quad . \quad . \quad . \quad . \quad (2)$$

which I finagled to find $b+g$ between 90 and 3000.

"So the fiddling and finagling brackets Toots' class between 90 and 110, with a probability of 100 for a random distribution of ages, so, April Fool, there's my answer."

"No fair!" howled Cal. "With your luck you could milk a porcupine without gloves! First, there's a gimmick on the valentines that cancels age distribution. Since each boy gave to younger girls and received from older girls, there were g per boy and bg in all, proving (2). Then you forgot to equate the presents to the valentines, making

$$b(b-1)+g(g-1) = 2bg \quad . \quad . \quad . \quad (3)$$

for which the general solution in integers is parametrically,

$$b = \tfrac{1}{2}m(m\pm1) \text{ and } g = \tfrac{1}{2}m(m\pm1) \quad (4)$$

whence $bg = \frac{1}{4}m^2(m^2-1)$

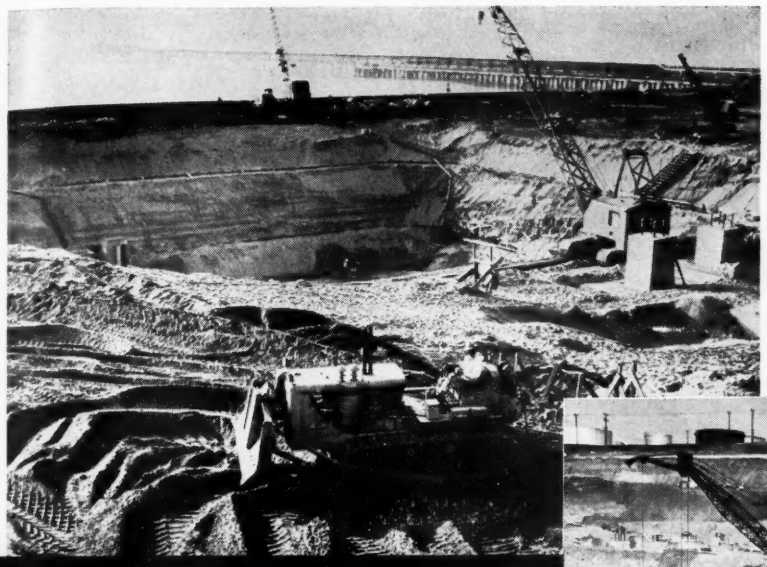
$$\text{and } b+g = m^2 \quad . \quad . \quad . \quad . \quad (5)$$

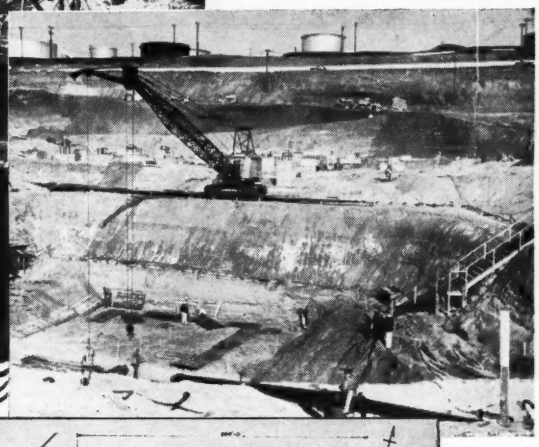
"Now it's easy to find $m=10$, $bg=2475$ and $b+g=100$, for when $m=9$, $bg=1620$, which is too small, and when $b=11$, $bg=3630$, which is too large. That was so easy that I don't see why we have to fool around with a fool like Joe."

"Just to give you a superiority complex," chuckled the Professor, "but you got even with him. He'll lie awake tonite wondering how you derived (4) as a solution to (3). Let's let him worry.

"You may be interested in a war story which has just been declassified. An adjutant comparing 3 successive morning reports from a detached battalion phoned its headquarters for explanation of a serious discrepancy. The enlisted strength for Wednesday was like that of Tuesday except that the left digit had been moved to the right end and the strength for Thursday differed from that of Wednesday in the same way. 'No mistake,' retorted the irate Major. 'We were ambushed Tuesday and lost one man from each squad. Reorganized in full squads, another ambush cost us a man for each on Wednesday. I now have 9 men in each squad so it can't happen again.' How many men were left?"

[*Joe was outnumbered by these Cal Klaters: Stoop (John L.) Nagle, Ed C. Holt, Jr., Murray S. Bornstein, S. L. Dum (Thomas Borman), Sauer Doe (Marvin Larson), A. Nuther Nutt, Don'T (Donald Thayer), M. L. Pei, and Thatchrite (Guy C. Thatcher).*]

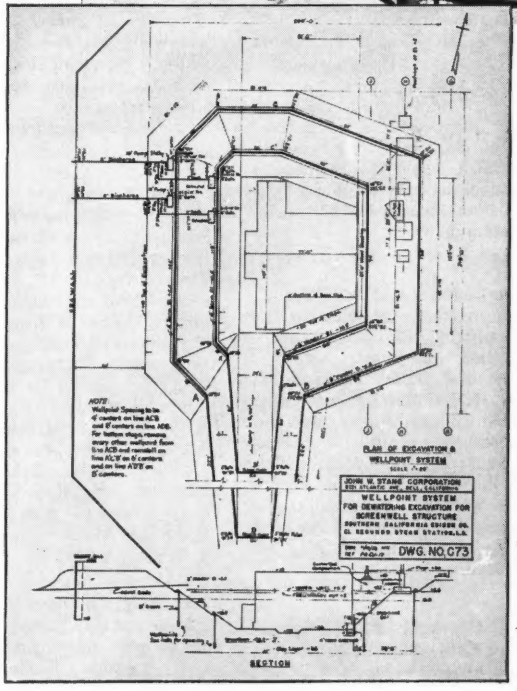




DRY WORK...
water under control!

STANG wellpoint job in beach sand...Down to 60 feet—30 feet below water level...*only 500 feet from ocean!*

Plans for an oceanside steamplant power station called for the construction of a reinforced concrete screenwell structure. Water and soil conditions were extremely adverse. The John W. Stang Corporation Engineering Service was called in. The resultant STANG plan (illustrated) *provided* completely dry excavation from the surface to a 60 foot depth . . . *utilized* dry-land excavation equipment 30 feet below water level . . . *made possible* the use of low-cost concrete forms. For fastest low-cost, construction when water is a problem . . . call STANG!



Putting water in its place

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DECEASED

George A. Belden (A.M. '19), age 66, assistant chief engineer of the Central of Georgia Railway at Savannah, Ga., died on January 9. Mr. Belden received a C.E. degree from Cornell University in 1911 and the following year joined the Central of Georgia Railway. Since then he had been assistant engineer, architect, engineer and, since 1950, assistant chief engineer.

Alfred R. Brodine (A.M. '30), age 58, who has been connected with the Huron Portland Cement Co., Detroit, since 1944, died in December. For ten years at the start of his career, Mr. Brodine was in the City Engineer's Office in Detroit—from 1926 to 1934 as engineer of tests. From 1935 until he joined the Huron Portland Cement Co. he had a private practice at Lake Orion, Mich.

Frederic Burroughs (A.M. '10), age 76, former senior draftsman for the Pennsylvania State Highway Department, Pittsburgh, died on December 17. A graduate of Rensselaer Polytechnic Institute in 1903, Mr. Burroughs had been in the Bureau of Filtration of the Pittsburgh Department of Public Works, and engineer and financial agent for various construction and sewage companies—the Petroleum Iron Works Co. and Standard Car Construction Co., both of Sharon, Pa., and Field, Barker & Underwood, a Philadelphia firm. In 1928 he became senior draftsman for the Highway Department at Franklin and in 1935 transferred to Pittsburgh.

C. Langdon Cheves (A.M. '47), age 42, vice-president in charge of sales for the Daniel Construction Company, Greenville, S.C., died on January 3. Mr. Cheves joined the Daniel Construction Company in 1936, following graduation from Clemson College with a civil engineering degree. During the war he was Colonel in the Army Corps of Engineers and commanding officer in charge of work on the Alcan Highway. Returning to the company later, Mr. Cheves worked on sales to further the company's plan for expanding southern industry.

Frederick L. Copeland (M. '19), age 71, of San Mateo, Calif., died on January 8. Mr. Copeland joined the Bates & Rogers Construction Company of San Francisco in 1905 and for many years was vice-president and director. He was a graduate of Yale University.

Woolsey Finnell (M. '17), age 88, engineer for Tuscaloosa County, Alabama, until his retirement in the late 1940's, died at his home at Tuscaloosa on January 26. After graduating from the Tuscaloosa Military Academy in 1887 Colonel Finnell was engaged in railroad construction and for nineteen years had a private practice. During World War I he commanded the 501st Engineers, and as commanding officer of APO 741 he built more than 100 miles of railroad yards and extensions and many other vital facilities. In 1919 he attended the Paris Caucus where his suggestion for naming the American Legion was adopted. During Colonel Finnell's administration of the Alabama State Highway Department as director (1927–1931) the state highway system was adopted and 3,000 miles of roads constructed. He had been a Master Mason for fifty years.

George Edward Franklin (A.M. '26), age 69, for many years an employee of the City of Dallas, Tex., died in Dallas, on February 5. After graduation from Purdue University in 1911, Mr. Franklin worked for various railroad companies and in 1925 joined the Texas Highway Department as division and resident engineer at Austin. In the thirties he started work for the City of Dallas and since then had been superintendent of streets and bridges, engineer of maintenance, and was most recently senior engineer.

Carl Otto Johnson (M. '44), age 70, Chicago bridge engineer, died on January 29. A graduate of Armour Institute of Technology, class of 1906, Mr. Johnson had been in the Bridge Division of the Chicago Department of Public Works for 48 years. He was resident engineer until 1944 when he was placed in charge of all bridge construction for the division.

Max W. King (M. '19), age 72, from 1947 to 1954 consulting engineer to the Secretary of Hydraulic Resources of Mexico, Mexico City, died at McAllen, Tex., on January 17. Mr. King had filled a number of important posts here and in Mexico. His Mexican assignments included superintendent of the J. G. White Engineering Company, 1928–1934; construction engineer for the U.S. Boundary Commission, 1934–1936; superintendent of the Mexican National Irrigation Commission, 1936–1937; and general superintendent on Marte Gomez Dam for the National Irrigation Commission. Mr. King graduated from the University of Wisconsin in 1909.

Lynn O. Knowlton (M. '20), age 70, of Middleton, Wis., died on December 3. An architectural engineer, Mr. Knowlton was structural engineer for the H. K. Ferguson Co., Cleveland, Ohio. Previously he had been associated with the Indianapolis firm, Bass, Knowlton & Co., where he was in charge of engineering design and supervision. Mr. Knowlton graduated from Purdue University in 1905.

Paul Gustave Lindeman (M. '48), age 70, since 1939 secretary-treasurer of the L. & K. Contracting Co., Inc., Terre Haute, Ind., died on January 3. A 1908 graduate of Rose Polytechnic, Mr. Lindeman was vice-president and chief engineer of the Foulkes Contracting Company of Terre Haute from 1910 to 1939 when he organized the L. & K. Contracting Company. For four years, 1943–1947, he was city civil engineer of Terre Haute.

John G. Little (M. '47), age 74, structural and civil engineer of San Francisco, died on February 26. Mr. Little graduated from the University of Alabama in 1902. In 1906 he started work with the San Francisco firm, Barker, Little & Hall, now known as J. G. Little & Company, with which he had been continuously engaged. Mr. Little also worked for the San Francisco City and County Department of Public Works as consulting structural engineer and superintendent of the Bureau of Building Inspection.

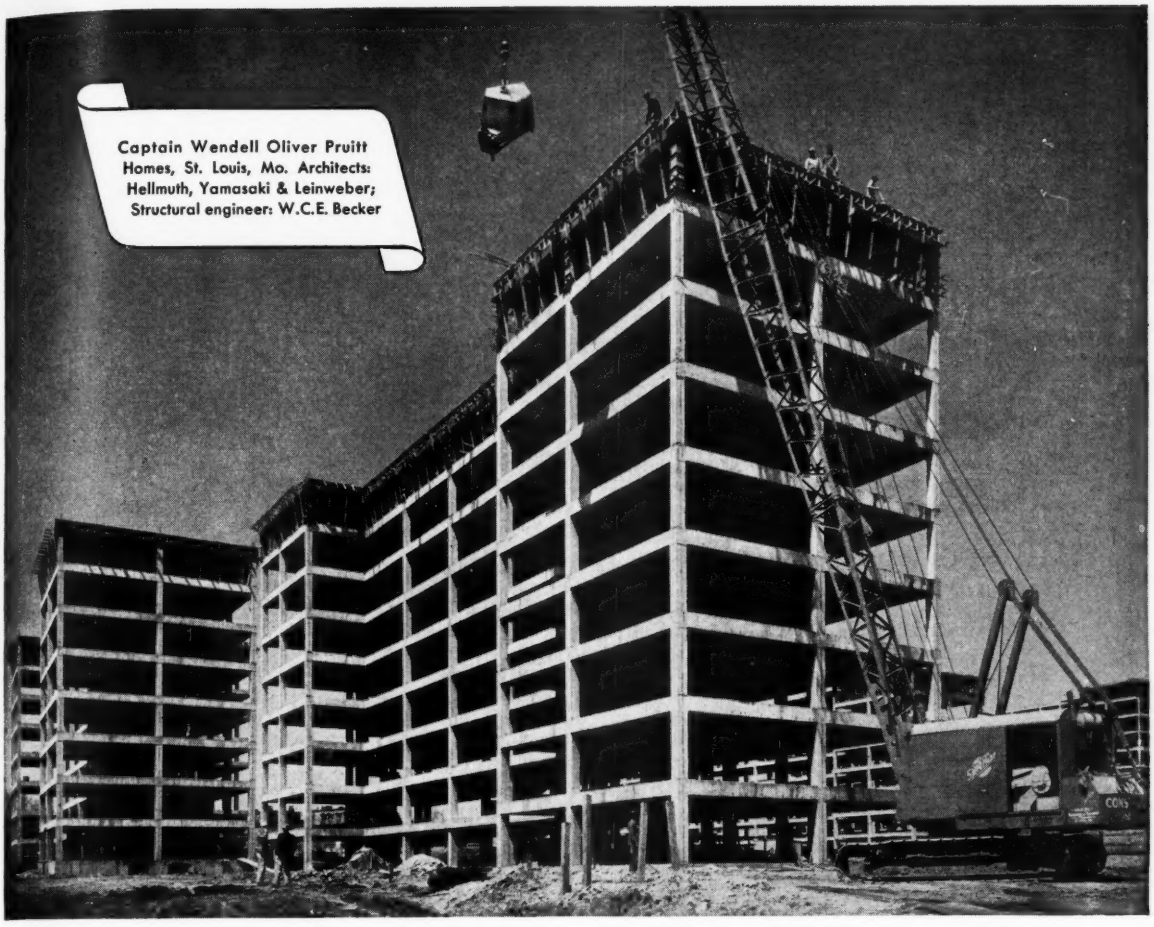
J. G. Little

Neal Dow McDowell (M. '44), age 55, district engineer for the U.S. Bureau of Public Roads in the State of Maine, died in Augusta, Me., on February 4. A graduate of Norwich University, class of 1924, Mr. McDowell's career was devoted to highway engineering. He began with the Illinois Bureau of Bridges in 1924 and then became assistant bridge engineer for the Vermont Highway Department. Since 1928, when Mr. McDowell joined the U.S. Bureau of Public Roads, he had been associate highway bridge engineer, highway engineer and, most, recently, district engineer. Mr. McDowell was active in the formation of the Maine Section, the New Hampshire Branch of the Maine Section, and the New England District Council. He served as the first president of the Maine Section and the first chairman of the District Council. The success of ASCE in the area is attributed, in large measure, to his continued active interest in local Society affairs.

N. D. McDowell

Harry C. Reeder (A.M. '16), age 70, retired civil engineer of Beverly Hills, Calif., died on January 22. At the start of his career, Mr. Reeder worked for various Western railways. In 1915 he joined the Division of Valuation of the Interstate Commerce Commission as assistant field engineer, and later worked for the California Highway Commission in Hollywood and Los Angeles as construction engineer. In the twenties Mr. Reeder started his Beverly Hills office where he practiced until his retirement.

(*Continued on page 88*)



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The St. Louis Housing Authority chose reinforced concrete frames and floors for its Captain Wendell Oliver Pruitt Homes. On 34½ acres, the project includes 20 eleven-story buildings, two million sq. ft. of floor area.

Critically-needed housing projects like the Pruitt Homes can be built faster and with greater economy when designed for concrete frames and floors. Those are two reasons why more and more modern apartment buildings are being built with this type of framing.

Reinforced concrete frame and floor construction offers architects, engineers, contractors and owners many advantages. For example, frame and floor construction proceed simultaneously. Walls can be finished as the building goes up. Facilities for heating and ventilating, as well as plumbing and wiring can be installed as the structural work progresses. This saves time and money.

Competitive bids and cost analyses show that savings up to 40% on frame and floor costs are possible with concrete. Concrete is sturdy and firesafe, gives years of service with little upkeep. This ***low annual cost*** is a bonus for owners, investors and tenants.

For help in designing reinforced concrete frames and floors for structures of any size or for any purpose—for apartments, schools, hospitals or commercial buildings—write for free illustrated literature. Distribution is limited to the United States and Canada.

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A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

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Deceased

(*Continued from page 86*)

Robert B. Reilly (A.M. '46), age 50, since January regional engineer for the American Institute of Steel Construction, Inc., at Dallas, Tex., was killed in an airplane crash near Albuquerque, N. Mex., February 19. A 1926 graduate of Texas A. & M. College, Mr. Reilly was for many years superintendent of the Austin Road Company of Dallas. Since 1948 he had been with AISC as district engineer with headquarters in Dallas. Before joining the Institute, Mr. Reilly worked for Powell & Powell in Dallas and the Muskogee Iron Works.

Francis R. Schanck (M. '14), age 77, consulting engineer of Portland, Oreg., died on January 10. A graduate of Stanford University, Mr. Schanck was engaged in consulting work most of his career, first in Los Angeles as a partner in Copeland & Schanck, then in Chicago in Schanck-O'Brien Co., and since 1923 in Portland. Mr. Schanck also worked for the U.S. Reclamation Service for two years and for three years was with the U.S. Indian Irrigation Service. During the war he was civil engineer in the Navy Department and the Defense Plants Corporation.

Thomas R. Tate (M. '45), age 66, former engineer for the Public Utilities Commission, Washington, D.C., died on February 8. An electric utilities expert, Mr. Tate worked for numerous private electric power companies at the start of his career. From 1932 to 1942 he was in Washington, D.C., holding various jobs with the Public Utilities Commission, the Public Works Administration, and the Federal Power Commission, and for a year (1934–1935) he was director of the National Power Survey. In 1942 he became the Washington representative for Charles T. Main, Inc. and later was made assistant project engineer. Recently he had been in Nallihan Baraji, Turkey, on the company's Sariyar hydroelectric project. Mr. Tate received a B.S.E.E. from the University of Missouri in 1912.

Elbert J. Taylor (A.M. '29), age 57, since 1946 chief of the Bureau of Water for the City of Philadelphia, died on January 23. Mr. Taylor worked for over sixteen years for Morris Knowles Inc. of Philadelphia, where he started in 1925 as engineer. In 1928 he was promoted to resident engineer and in 1939 became office engineer. Mr. Taylor graduated from the University of Cincinnati in 1923.

Roswell D. Trimble (M. '18), age 83, head of the consulting engineering firm of R. D. Trimble & Company, Richmond, Va., died at Middleburg, Va., on February 2. Mr. Trimble started his own firm in 1920 for consulting and construction work in civil and hydraulic engineering. Earlier he had worked for Winston & Company of Richmond. Educated at the College of the City of New York, Mr. Trimble was author of several hydraulics works.

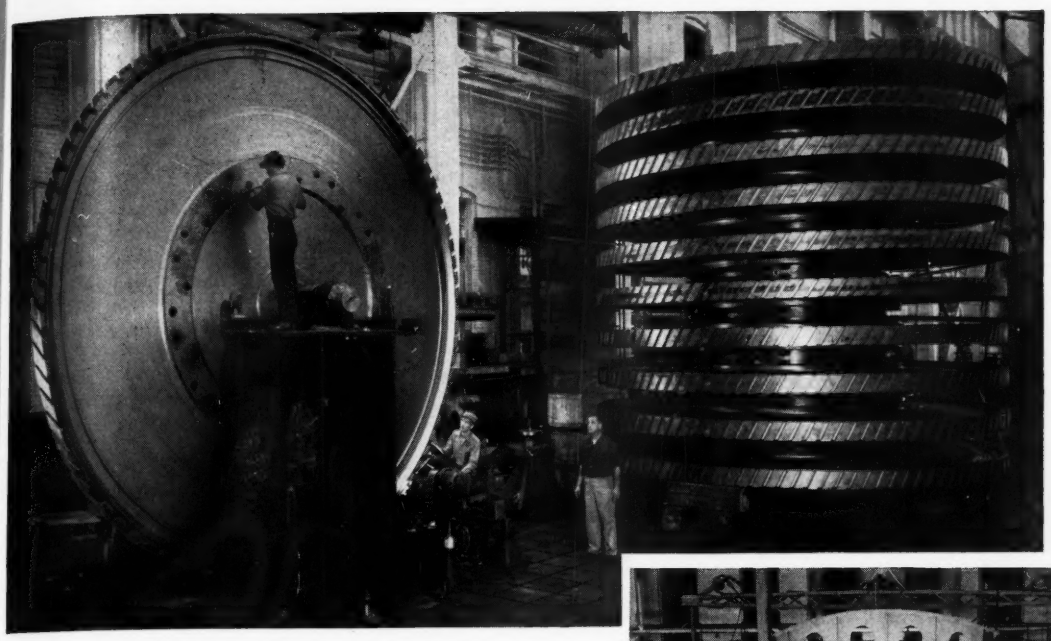
Herman F. Tucker (M. '39), age 77, consulting structural engineer of Seattle, Wash., died on February 1. A graduate of Harvard University, Mr. Tucker spent five years with the Boston firm, J. R. Worcester and four as designing engineer on the Panama Canal locks and dams before opening his office in Seattle in 1912. His projects included the study of locks for the Columbia River Survey. Mr. Tucker retired in 1944.

Claude A. P. Turner (M. '01), age 85, technical writer and consulting civil engineer of Columbus, Ohio, died on January 10. After graduation from Lehigh University in 1890, Mr. Turner worked for various railroads and bridge construction firms. His projects included numerous bridges in the West—the Bismark-Mandan Bridge over the Missouri and the Wabasha Bridge over the Mississippi. He also did work on mining buildings and concrete structures here, in Canada, Australia, India and Cuba. Mr Turner was manager of the C. A. P. Turner Company, consulting engineer to the Soo Line Railway, and owner of the Theodore A. Wegener Company.

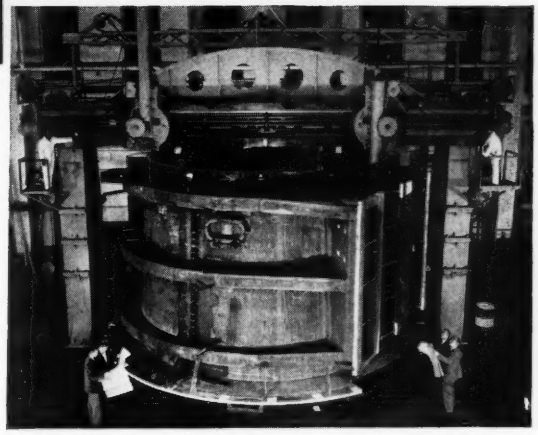
Frederick K. Wing (M. '27), age 85, consulting engineer of Kenmore, N.Y., died on January 27. An 1890 graduate of Cornell University, Mr. Wing had a civil engineering office specializing in sewage disposal in Buffalo from 1894 to 1935. He was chief engineer of the Niagara Frontier Planning Board from 1935 to 1937 and then became city engineer of Buffalo In 1942 he opened an office in Kenmore.

Alan A. Wood (M. '43), age 63, president of Alan A. Wood, Inc., Philadelphia, Pa., died on January 29. After graduating from Brown University in 1911, Mr. Wood joined Builders-Iron-Foundry of Providence, R.I., as sales engineer. Associated with B-I-F for forty-two years, Mr. Wood was representative in the Philadelphia, Washington, and Richmond areas. During the war he worked in Washington, D.C., for Proportioneers, Inc., and Cleaver-Brooks Co. In 1945 he formed and became president of his own company, which was associated with B-I-F.

Alan A. Wood



Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment ... *standard or special in design.*



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

To create winds exceeding

2000 MPH

Newport News builds world's Mightiest Compressor

Whenever you want large units built with careful attention to detail, give the job to Newport News.

This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force ... using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005" on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.

Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines ... from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" ... it's your for the asking.

Newport News

Shipbuilding and Dry Dock Company

Newport News, Virginia

Employment conditions and leadership . . .

(This article begins on page 38)

(*Continued from page 40*)

of all except the most eminent posts in management. Outstanding technical achievement is more valuable to society because it is rarer, and society loses when an eminent technologist becomes a top executive. Some organizations recognize this fact by placing their eminent scientists and engineers in the same salary bracket as their chief administrators, and the trend is growing.

Politics and engineering

There is no affinity between engineering skill and political skill; they are completely different. Tact, good expression and persuasiveness are assets making professional skill more effective, but where such technical skill is absent no amount of political skill can prevent failure. It is most unfortunate when the executive head of an engineering organization is selected on the basis of political considerations, even though at the moment it may be a matter of expediency. The acid test of professional competence will come sooner or later in the laboratory of daily routine, and at a critical time the organization will face embarrassment. One who owes his appointment to company or partisan politics is burdened with an allegiance which may be contrary to the best interests of his organization. A dichotomy of technical and political policy will soon be revealed, resulting in a loss of public confidence. Political pressures which interfere with absolute objectivity in the selection of the best man available for any position undermine the moral authority which is the only safeguard to the public interest.

Leaders are responsible to the group they serve, and the acceptance of this responsibility is today the mark of the successful executive. His devoted sense of obligation to those who follow him is the incentive which drives him forward when harassed by discouragement and doubt. No longer is true leadership an aloof, domineering assertion of authority. It is an earnest and sincere application of the principle of give and take which evokes loyalty and a devotion to duty in all who serve.

Men now rising through the ranks will be among the leaders of the future and will derive their inspiration from those now at the helm. That leaders today are aware of the implications of this inspiration for good or for evil augurs well for the future.

(*This article has been prepared from Mr. Glidden's Presidential Address before the opening session of ASCE's San Diego Convention.*)

Roll-On Joint Pipe For Permanence!

The ROLL-ON JOINT pioneered by the American Cast Iron Pipe Company and accepted as a standardized joint of the cast iron pressure pipe industry, is now available in both large and small diameter pipe. Roll-On joint pipe was introduced sixteen years ago.

Roll-On joint pipe is cast centrifugally by the Mono-Cast process in sizes 2″ through 48″. Standard joint materials, including rubber ring, jute and bituminous joint compound are furnished with the pipe. Roll-On joint pipe is easily and quickly assembled by unskilled labor.

This type of pipe is offered as an alternate for standard Bell and Spigot pipe. Having a positive rubber-packed bottle-tight joint, Roll-On is lower in first cost than other types of joints. It is included in the new Federal Specification WW-P-00421 as Joint Type II.

The above illustration shows 48″ AMERICAN Roll-On Joint pipe being used in the construction of a 7 mile-long-water supply line in Texas. Depending upon local conditions, the contractor laid from 500 feet up to 1,000 feet per day. The final tests on the line showed the Roll-On Joints to be bottle-tight.

Users of this type of cast iron pipe are enthusiastic about it.

AMERICAN

1905 - GOLDEN ANNIVERSARY - 1955

AMERICAN CAST IRON PIPE CO. 50 YEARS BIRMINGHAM, ALABAMA

Non-ASCE Meetings

Air Pollution Symposium. Third National Symposium at the Huntington-Sheraton Hotel, Pasadena, Calif., April 18–20. Sponsors are the Stanford Research Institute, California Institute of Technology, the University of California, the University of Southern California, the Air Pollution Control Association, and the Air Pollution Foundation.

American Association for the Advancement of Science. International Arid Lands Meetings at Albuquerque and Socorro, New Mex., April 26–May 4. Annual meeting of the Southwestern and Rocky Mountain Division in Santa Fe, April 24–26. Hosts are the Museum of New Mexico and Region Three Office of the National Park Service.

American Institute of Steel Construction. Seventh Annual Engineering Conference at the Hotel Muehlebach, Kansas City, Missouri, April 18–19.

American Society of Mechanical Engineers. Special 75th anniversary program at Stevens Institute of Technology, Hoboken, April 16, to mark the college's contribution to mechanical engineering.

Alabama Structural Engineering Conference. Sponsored by Alabama Polytechnic Institute at Biggin Hall, A.P.I., Auburn, Alabama, April 29 and 30. Information from Dr. Earl I. Brown II, Department of Civil Engineering, Alabama Polytechnic Institute, Auburn, Alabama.

Building Research Institute. Fourth Annual Meeting at Woodrow Wilson Hall, Princeton, N.J., April 18–19.

Michigan State College. Centennial celebration symposium, "Automation-Engineering for Tomorrow," at East Lansing, May 12–14.

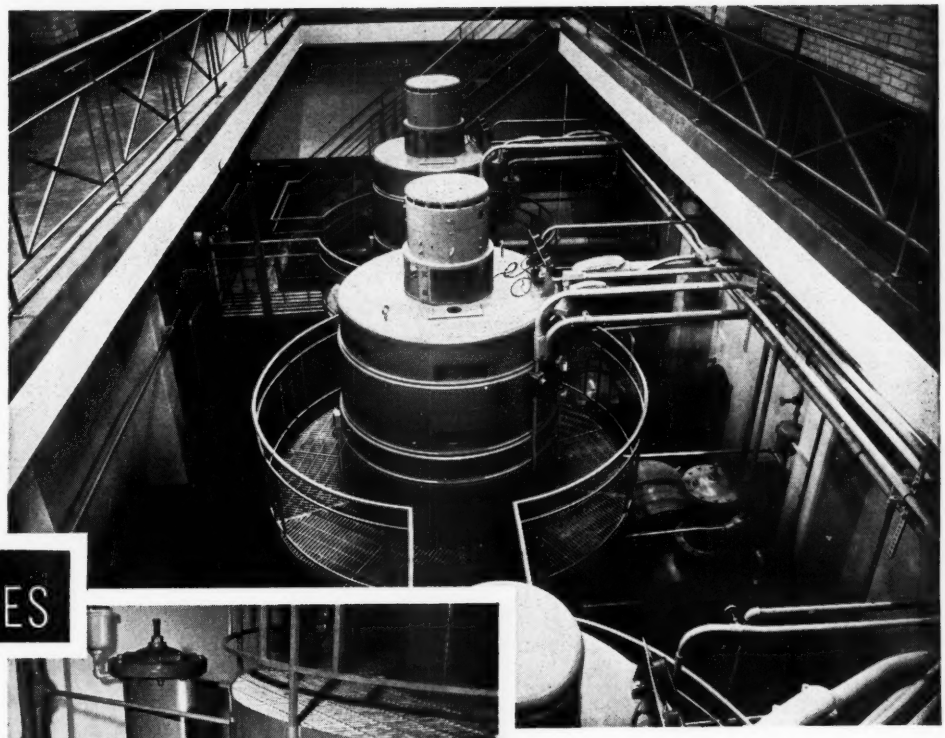
Purdue University. Tenth Purdue Industrial Waste Conference at Purdue Memorial Union, Lafayette, Ind., May 9–11.

Society for Experimental Stress Analysis. Spring Meeting at the Hotel Statler, Los Angeles, Calif., April 27–29. Information from C. R. Smith, chairman S.E.S.A. Spring Meeting, c/o Engineering Test Laboratories, Convair, San Diego 12, Calif.

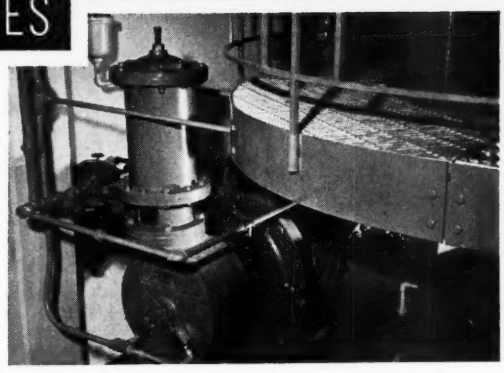
Society of American Military Engineers. Thirty-fifth Annual Meeting at the Waldorf-Astoria, New York City, May 5–6. Information from Secretary S.A.M.E., 10th floor, 346 Broadway, New York 13, N.Y.

Steel Joist Institute. Annual Meeting at the Greenbrier, White Sulphur Springs, W. Va., April 12–13. The Institute's address is Dupont Circle Building, Washington 6, D.C., Managing Director, C. H. Luedeman.

University of Missouri. Structural Engineering Conference sponsored by Civil Engineering Department at the University of Missouri, Columbia, Mo., May 20–21.



SMS
ROTOVALVES



Ten hydraulically operated SMS-Rotovalves here range in size from 18" to 30".

Engineers: Greeley & Hansen, Chicago.

For the City of Niagara Falls, N. Y. . . .

SMS-ROTOVALVES SAFEGUARD HIGH AND LOW SERVICE PUMPS

SMS-Rotovalves were specified to safeguard service pumps in the City of Niagara Falls' new pumping station. Greater initial shut-off and positive control of closing time made them a logical choice to minimize water hammer in pump start-ups and shutdowns. Because SMS-Rotovalves have less pressure loss with a full line opening than other valve types, they save pumping power.

In addition to the SMS-Rotovalves, SMS Babbit-Seated Butterfly Valves meet the rugged, high service header requirements of fast, positive closure. At the adjacent filtration plant, 76 R-S Rubber-Seated Butterfly Valves were specified to give drop-tite closure, unusual economy of layout space and cut initial construction costs.

Whatever your application requirements, SMS has the experience and facilities to meet them. For additional information on our complete line of cone, ball and butterfly valve, see our local representative or write the S. Morgan Smith Company, York, Pennsylvania.

Hydraulic Turbines
Pumps
Gates & Hoists
Trash Rakes
Accessories

HYDRODYNAMICS

Rotovalves
Ball Valves
Butterfly Valves
Free-Discharge Valves
Controllable-Pitch Ship Propellers

SMS
S. MORGAN SMITH CO.

AFFILIATE COMPANY: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Positions Announced

Minnesota Civil Service. The State has positions in Civil Engineer I for work in field, office, or laboratory throughout the state. Applicants must have a C.E. degree and experience in engineering which may be sub-professional. They must be U.S. citizens and two-year residents of Minnesota. Salary range is $350–400 a month. There is a written examination. Application blanks and information may be obtained from the Minnesota Civil Service Department, State Office Building, St. Paul 1, Minn.

City of Burbank, Calif. Applications for the position of Planning Director, at a salary range of $696–864 are open in Burbank, Calif. Applicants must live in California when applying. Requirements include graduation and either five years technical planning experience in a city or county planning department or two years recent experience as planning director or assistant planning director of a city or county planning department. Examinations will be held in Los Angeles and Burbank. Applications and additional information from Civil Service Department, City Hall, Burbank, Calif.

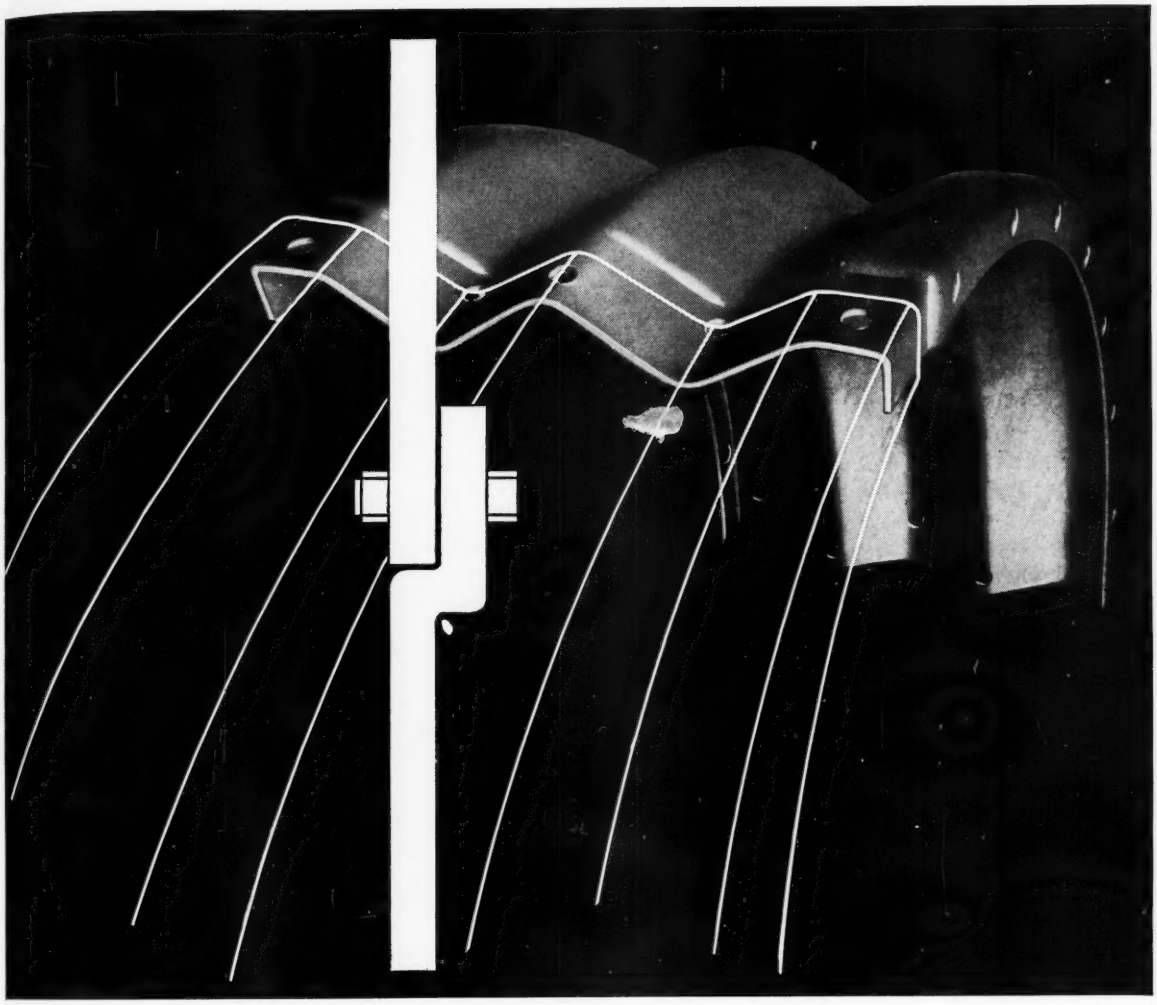
City of Glendale, Calif. The position of Plan Checking Engineer at a salary of $445–556 per month is open in the Building Division of the City of Glendale. Applicant must be a civil or structural engineer, 23–45 years, with an appropriate college degree and two years experience in either field, or an equivalent combination of training and experience. Registration is not required. Further information may be obtained from the Civil Service Commission, 613 East Broadway, Glendale, Calif.

UNESCO. Two engineering vacancies are open in UNESCO's Technical Assistance Programme. One is for Professor and Head of the Civil Engineering Department at the Indian Institute of Technology at Kharagpur, India. Applicant should have a high-level university degree and ten years' experience in teaching and research. The other is for an expert in Civil Engineering to lecture to the faculty at the Syrian University at Aleppo, Syria. He will organize the public works laboratories and will advise industrial firms in Syria. To qualify applicants must have a high level of engineering skill and, if possible, experience in teaching and laboratory work. The languages are English and French. Write UNESCO, United Nations, New York, N.Y.

City of Los Angeles. Los Angeles is accepting applications for the position of Chief Harbor Engineer with an annual salary range of $14,040–17,484 per year. Requirements are five years of administrative experience as chief or assistant chief harbor engineer in charge of the design or construction and maintenance of harbor and marine terminal facilities. Registration as a civil or professional engineer in any state is acceptable, and California registration is required before appointment. Applications will be reviewed prior to admission to the written test. Applications to the Civil Service Department, Room 5, Los Angeles City Hall, Michigan 5211, Los Angeles, Calif.

City of Richmond, Va. Richmond needs a Traffic Engineer. Salary range is from $6,240–7,488. Applicants must be 25 to 45, graduates of a recognized school of engineering, and have five years of experience in traffic engineering, with four years in responsible charge of such work. A driver's permit is needed. Apply to the Department of Personnel, Room 314, City Hall, Richmond, Va.

(Continued on page 96)



"Overlapping grip" gives tunnels more strength

The strength/weight ratio of individual liner plates is important. Even more important is the strength of a tunnel structure after the plates are assembled.

Armco Liner Plates win on both counts. On a pound-for-pound basis, Armco corrugated metal design provides the strongest individual plate. Then, going a step further, Armco Engineers took a cue from golf experts and designed the "overlapping grip." Longitudinal joints are of the offset lapped type. Circumferential corrugations are continuous through the joint to provide a ring of uniform strength. On a pound-for-pound basis, it is *the strongest liner plate structure made.*

This was demonstrated in tests—in both joint compression and bending. They indicated that you can save 20% to 40% in pounds-per-square-foot on an equal strength basis with Armco Liner Plates. Thus you can reduce the amount of metal to buy and handle without sacrificing strength!

Structures formed from Armco Liner Plates can be round, elliptical, or almost any curvature of arch. They are used for sewers, conduits, service tunnels, underpasses, shafts, caissons, aggregate tunnels, storage bins and for lining failing structures. For more specific data, write us. Armco Drainage & Metal Products, Inc., 4765 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO LINER PLATES

MANUFACTURERS OF: MULTI-PLATE PIPE, ARCH AND PIPE-ARCH • CORRUGATED METAL PIPE • WELDED STEEL PIPE • FLEX-BEAM GUARDRAIL • WATER CONTROL GATES • RETAINING WALLS • STEEL BUILDINGS • SHEETING • BRIDGE PLANK • TUNNEL LINER • SUB-DRAINAGE PIPE • END SECTIONS • PIPE PILING AND PILE SHELLS

ARMCO®

Positions Announced

(*Continued from page 94*)

Ponca City, Okla. City and Regional Planning Engineer is wanted for community of 30,000 with strong support for planning. Salary is $6,000 plus opportunity for advancement in the executive branch of the city government. Address application to City Manager, Ponca City, Okla. Applicants should give their full background.

New York State Civil Service Department. An open examination is being held for Junior Sanitary Engineer (No. 144) at $4,350–5,460, in the Department of Conservation at Freeport, L.I., and the Department of Health in various locations. Requirements are a C.E. degree and either a master's degree or experience in engineering. Application forms may be obtained from the New York Civil Service Department, Governor Alfred E. Smith State Office Building, Albany 1, N.Y.

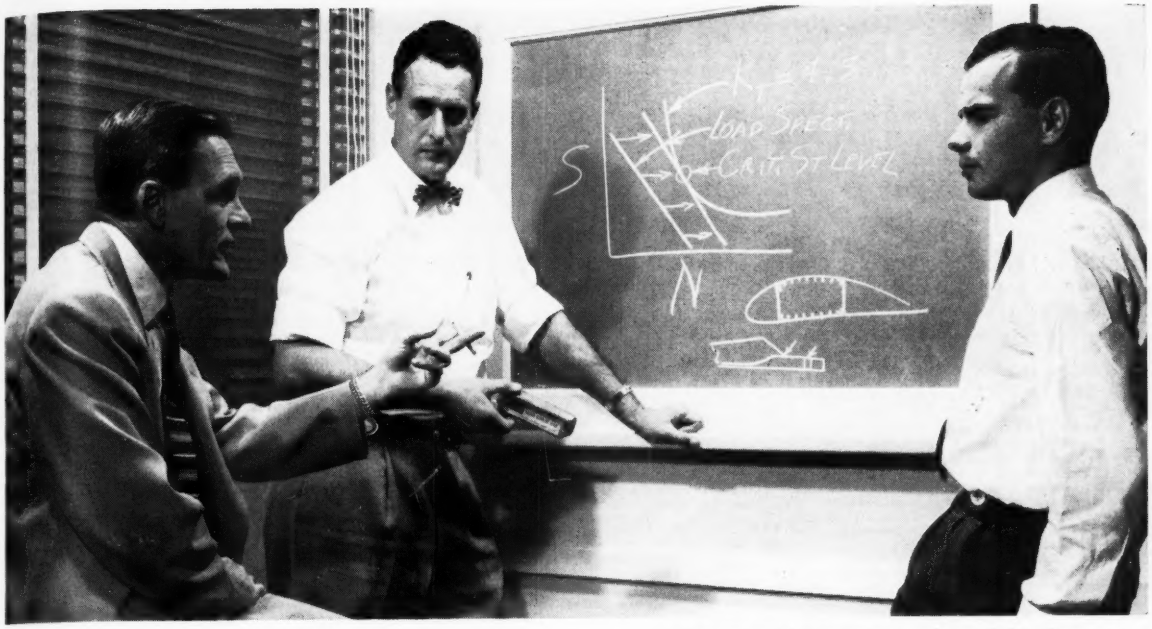
The City of Warren, Ohio. Warren has vacant the following positions in the City Engineering Department: First Assistant Engineer, Class A—$477, Class B—$530, and Class C—$556.50. Positions for second assistant engineer Class (A-C) are also open. In the City Water Department, the position of Supervisor of Distribution and Chief Engineer at $583 a month is also open. Requirements are a C.E. degree.

Navy Department. Two positions are open for Navy Structural Research Engineer (GS-12) at $7,040 per year for research and evaluation of structural strength of surface ships and submarines. B.S. degree in engineering plus five years combined graduate study and/or professional experience in experimental stress analysis or theoretical engineering mechanics is required. For further information contact the Employment Officer, David Taylor Model Basin, Washington 7, D.C.

Veterans Administration. There are several engineering positions open in the Veteran Administration Central Office in Washington, D.C. These include Engineers (GS-9, at $5,060) and Sanitary Civil Engineer and Structural Building Engineer (GS-11, at $5,940). Requirements include a C.E. degree or four years of experience in technical engineering. No Civil Service examination will be given. Additional information may be obtained from the Central Office Personnel Service, Veterans Administration, Washington 25, D.C.

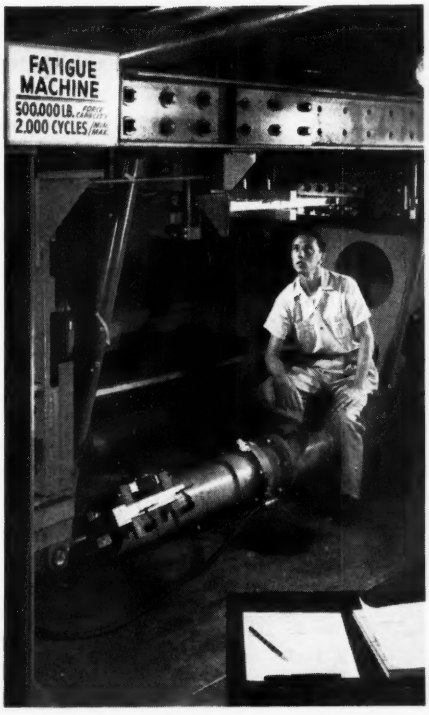
New York District Corps of Engineers. There is an urgent need for engineering personnel to fill numerous vacancies on military construction projects in New York State. The positions are: Structural Engineers and Hydraulic Engineers (GS-9, at $5,060); Cartographic Draftsman (GS-7, at $4,205); and Construction and Civil Engineers (GS-9, at $5,060). Locations are in New York State. Apply to the Personnel Branch, Office of the District Engineer, Corps of Engineers, New York District, 9th floor, 111 East 16th St., N.Y. 3, N.Y.

U. S. Civil Service Commission. Highway Engineers and Highway Bridge Engineers (Grades GS-7 to GS-11) are needed throughout the country in the Bureau of Public Roads. To qualify, applicants must have had an appropriate education—a college degree of engineering—or four years' experience or a combination of education and experience, and one to three years of professional engineering experience partly in highway bridge or highway engineering. No written test is required. Salaries range from $4,205 to $5,940 a year. Further information and application forms may be obtained from the U.S. Civil Service Commission, Washington 25, D.C. Applications must be filed with the Executive Secretary, Board of U.S. Civil Service Examiners, Bureau of Public Roads, Washington 25, D.C.



J. F. McBrearty, chief structures engineer (left), discusses fatigue test program of integrally-stiffened wing lower surface structure of Super Constellation Model with E. H. Spaulding, structures division engineer and J. G. Leewolt, stress engineer. Lockheed's 500,000 lb. Force Fatigue Machine was used in test program.

Advanced structures facilities speed careers of Lockheed Engineers



Ralph Oliva, research engineer, examines Super Constellation skin for signs of fatigue failure.

Engineers in Lockheed's Structures Division are supported by unmatched research and testing facilities in their constant effort to increase strength while decreasing weight.

Among those facilities are the Lockheed-designed 500,000 Lb. Force Fatigue Machine, first of its size; Shimmy Tower, only one in private industry; and Drop Test Tower, largest in the nation.

Facilities such as these give engineers a major advantage in making technical advances – and thus advancing their careers. Moreover, the large number of projects always in motion at Lockheed mean continuing opportunity for promotion as well as job security.

Why Lockheed needs Engineers with Structures training:

1. "Fail-Safe" Structures – Lockheed has begun an extensive pioneering effort in the new concept of "fail-safe" structures. Studies are being applied to virtually all phases of Lockheed's diversified development program – already the largest in the company's history.

2. New studies in: Effect of high temperatures on structures; optimization of thin-wing designs and other aero-elastic problems; new materials such as ultra-high heat treat steel; panel instability at extremely high speeds.

Engineers interested in the "Fail-Safe" program and other studies are invited to write E. W. Des Lauriers, Dept. S-1-4.

Lockheed
AIRCRAFT CORPORATION
BURBANK, **California**

ENGINEERING SOCIETIES

PERSONNEL SERVICE, INC.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th ST.	84 E. RANDOLPH ST.	100 FARNSWORTH AVE.	57 POST ST.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

ESTIMATOR; J.M. ASCE; pricing, take-offs, costs—heavy construction including bridges, highways, docks, railroads. Has initiated cost systems, closed with subs, and purchases. Eleven years' experience includes positions as project manager, design engineer, and cost engineer on jobs, including excavation, piling, concrete and utilities. Graduate C.E.; P.E. Location, New York Metropolitan Area. C-33.

CIVIL ENGINEER; J.M. ASCE; registered engineer; B.S.C.E.; some graduate work; three years' military service; two years' municipal work; four years' teaching in applied mechanics and surveying. Available June. C-34.

CONSTRUCTION ENGINEER; J.M. ASCE; B.S.C.E. 1950; 30; married; five years in responsible position as field engineer in steel mill and industrial construction. Competent in all types of excavation, layout, supervision and quantity take-off. Available as Area Engineer or Field Superintendent. C-35.

CIVIL ENGINEER; J.M. ASCE; 32; married; B.S. and M.S. in C.E.; four years' responsible charge of engineering soil mapping project consisting of research, airphoto interpretation, sampling, testing, map making, report writing. Desires position in construction or with consulting firm in soils engineering, field and office work. Will travel. C-36.

CIVIL ENGINEER; A.M. ASCE; B.S.C.E. 1941; married; four years' experience in hydraulics, irrigation and water supply; ten years' experience in plane and precision surveying and mapping with six years in responsible charge of operations in South America; speaks Spanish fluently. Location preferred, western States or Foreign. C-37.

CONSTRUCTION ENGINEER; J.M. ASCE; five years' experience in field and office with small construction firm; superintendent on buildings up to half million; estimate and bid buildings up to one million; designs small buildings and deals directly with clients; B.S.C.E.; Registered P.E. Connecticut and Rhode Island; age 28; married; children. Desires chance for advancement in responsible position. C-38.

CIVIL INDUSTRIAL ENGINEER; J.M. ASCE; 32; married; three years' machine tool and powerplant experience; two years as aircraft structures engineer; last three years in responsible field and office work in heavy construction. Seeks administrative or sales position in construction management or plant engineering. Speaks German, Spanish, French. Relocate or overseas. C-39.

CIVIL ENGINEER; J.M. ASCE; 24; married; B.S.C.E. '54; M.S.C. '55 from Yale University; available late June; desires position with engineering or constructing firm; interested in structural or highway work; willing to travel. C-40

CIVIL ENGINEER; A.M. ASCE; B.S.C.E. 1938 V.P.I.; 39; Registered; Member NSPE; sixteen years' experience in construction, design, surveying, and maintenance, including military posts and airfields, shipyard, railroads, hospitals, and AEC Plant. C-41.

CIVIL ENGINEER; J.M. ASCE; 30; married; B.S.C.E. '49; Registered C.E. in California; five years' experience in concrete, masonry, steel building; concrete and timber bridge construction; last two years as head of a design office; also experienced in investigations, designs estimates and reports. Desired location, California. C-42.

Positions Available

INSTRUCTOR OR ASSISTANT PROFESSOR; M.S. in civil engineering; to teach surveying, soil mechanics, fluid mechanics and normal civil engineering laboratories. Should be active in technical and professional organizations. Salary and academic rank open. Position starts September 1955. Location, Midwest. W-868(a).

INSTRUCTOR; civil engineering; preferably with M.S. degree; practical or teaching experience; major interest, sanitary engineering, desired but not required. Position open in the fall of 1955. Location, Midwest. W-923.

ENGINEERS; (*a*) Sanitary Engineer; five to ten years' experience; to take charge of design and making general layouts, as well as supervising other draftsmen. Salary $7,200-$8,400 a year. Location, western Pennsylvania. (*b*) Resident Engineers; residence required at the site of operations, mostly in and around Pennsylvania. Salary, $7,800–$8,400 a year. W-945.

INSTRUCTOR; civil engineering graduate; young; preferably with M.S.; for eight and one half month school year. Salary, $4,000 a year. Location, Pennsylvania. W-979.

STRUCTURAL DESIGN ENGINEER; graduate; 30–50; with seven to eight years' experience, three of which were in the design of steam power stations. Will design both structural steel and reinforced concrete and make a presentable drawing. Location, western Pennsylvania. W-983.

INSTRUCTOR; in civil engineering; M.S. degree; with some practical experience; to teach the fields of transportation and surveying. Salary, $3,600-$4,750 for nine-month academic year. Compensation for summer work. Location, Pennsylvania. W-989.

DESIGN DRAFTSMAN; preferably civil graduate; with four to six years' experience covering design and layout of industrial buildings. Salary, $6,600–$6,900 a year. Location, New York, N.Y. W-995.

RESIDENT ENGINEER; to supervise and be in complete charge of construction of large storm water drains. Must have knowledge of tunneling under tracks, piling, etc. Salary, about $10,000 a year. Location, Westchester County, New York. W-1025.

CHIEF ENGINEER; to take charge of all new design and construction, replacement of worn and obsolete equipment; must know about the operation of water softening plants and sewage treatment plants. Salary, about $10,000 a year. Location, South. W-1033.

ASSISTANT DIRECTOR OF PUBLIC WORKS; civil graduate; experience essential in street design and construction, storm water drainage and related work. Executive ability desirable. Salary, $7,200 a year. Location, South. W-1047.

ESTIMATORS; (*a*) Senior Estimator; with considerable experience; to supervise all estimating on chemical plant construction. Salary, $7,800–$10,800 a year. (*b*) General Estimator; civil engineer; for chemical plant construction. Salary, $5,400–$6,500 a year. Location, New York, N.Y. W-1056.

TEACHING PERSONNEL; (*a*) Instructor; young; preferably with M.S. in civil engineering. Salary open. Position available fall of 1955. (*b*) Assistant or Associate Professor; with at least M.S. in civil engineering and considerable training and experience in various aspects of highway engineering. Salary open. Postions available fall of 1955. Location, Midwest. W-1073.

STRUCTURAL ENGINEER; with steel and timber design and construction experience to supervise layouts, prepare specifications and estimates covering cooling towers, supports, and pumping equipment. Salary, $5,200–$6,500 a year. Location, New York, N.Y. W-1087.

(*Continued on page 100*)

Men and Jobs Available

(*Continued from page 99*)

CHIEF CONSTRUCTION ESTIMATOR; civil graduate; under 55; with at least ten years' supervisory estimating experience covering steam and hydro-electric power plants and general heavy construction projects. Salary, $10,000 a year. Location, New York, N.Y. W-1108.

CONCRETE AND STRUCTURAL STEEL DESIGNERS; graduate in civil or structural engineering; experienced in oil refinery, chemical plant or steel plant design or other heavy construction. Salaries open. Location, Ohio. W-1109(a).

ENGINEERS; (*a*) Architectural Draftsman; not a senior designer, but production draftsman on working drawings, floor plans, elevations, sections, etc. (*b*) Structural Designer-Draftsman; on technical design of such buildings in steel and concrete. Salaries open. Location, New York, N.Y. W-1142.

SALES ENGINEER; young; civil; with field engineering experience in concrete construction or road building for sales and promotion work covering materials. Salary, $4,800 a year, plus car, expenses and bonus. Location, New York, N.Y. W-1149.

ENGINEERS; (*a*) Structural Engineers; designers and detailers; with some experience in reinforced concrete and steel for commercial and industrial construction. Salary open. (*b*) Specification Writer; with ten to fifteen years' experience in building construction and capable of writing specs for civil, electrical and mechanical construction. Salary open. Location, New York, N.Y. W-1183.

DESIGN ENGINEER; preferably civil engineering graduate; with at least five years' highway or airfield experience covering design, specs and general engineering of asphalt construction. Salary, $9,000–$10,000 a year. Location, Foreign. F-1186.

ENGINEERS. (*a*) Outside Superintendent; civil; with experience in pile driving. Salary open. (*b*) Office Estimator; civil; 30-35; with experience in heavy construction. Salary open. Location, New York, N.Y. W-1205.

FIELD ENGINEER, Civil graduate, for heavy concrete construction project. Must have five years' heavy industrial experience. Salary open. Location, New York, N.Y. W-1219.

RESIDENT AND DEVELOPMENT ENGINEER; graduate C.E.; to 40; with three years' in building construction, mostly in use of concrete production. Good background in math and structural design. Duties will require delving into facets of concrete masonry units and concrete masonry construction. One study will explore plant drying methods for concrete blocks, another will deal with mortar joint strength in walls and ways and means for improving mortar joint strength. Should be able to plan and set up laboratory experiments entailing the instrumentation of test specimens and measurement of strain and deformation under load and other conditions. Should be able to analyse and write satisfactory reports with practical interpretations. Salary, $5,400–$7,800 a year. Company will negotiate fee. Location, Northern Chicago suburb. C-2664.

SANITARY ENGINEER; C.E. or Sanitary degree; to 40; with at least five years' experience in sewage plants and water works and pollution abatement design and/or construction. Knowledge of concrete helpful. Will do promotional work for trade association. Salary, $7,200 a year. Traveling. Location, Chicago, Ill. C-2697.

Applications for Admission to ASCE, February 12, 1955–March 5, 1955

Applying for Member

DUTTON BIGGS, Kansas City, Mo.
VILHELM BOGVAD-CHRISTENSEN, San Francisco, Calif.
WEBSTER LEROY BOLAND, Tulsa, Okla.
GEORGE ELI CHOTAS, New York, N.Y.
WILLIS HAWLEY CROPSEY, St. Paul, Minn.
DALLAS THORNTON DAILY, Raleigh, N.C.
RUSSELL SIMON DITTMER, Chattanooga, Tenn.
WILBUR MORRIS FRANCIS, Decatur, Ill.
WILLIAM SEVIER GARDNER, JR., Miami, Fla.
ALEXIS LAZAR GLUCKMANN, New York, N.Y.
MANUEL FRANCIS GONZALEZ, Pensacola, Fla.
ANTON GRZYWIENSKI, Vienna, Austria.
DOUGLAS MARSHALL HAAS, Baytown, Tex.
EARL LEONARD HARMON, Boise, Idaho.
VINCENT JOHN JOHNKOSKI, Charleston, W. Va.
HENRY RICHARD LACEY, Washington, D.C.
AUGUST HENRY LAMACK, St. Louis, Mo.
ARTHUR ALEXANDER LARSON, Minneapolis, Minn.
DESOTA BEN MCCABE, JR., Park Ridge, Ill.
FREDERICK LEON MCDONALD, Little Rock, Ark.
MANUEL COELHO MENDES DA ROCHA, Lisbon, Portugal.
WILLIAM ALMON MILAN, Charleston, S.C.
HUBERT STAUFFER MILLER, Great Falls, Mont.
FRANK HUXLEY NOWACZEK, Miami, Fla.
VAN EATON NUTLEY, Washington, D.C.
JOHN LENDYL RICHERSON, Los Angeles, Calif.
ARTHUR EDWARD ROBINSON, Delmar, N.Y.
FLOYD MCKINLEY ROUSH, Denver, Colo.
CHARLES PAUL SMITH, Baltimore, Md.
HERMAN ELMO SMITH, JR., Oklahoma City, Okla.
THOMAS HOWARD STEVENSON, Albany, N.Y.
ERASTS VIKSNINS, Matawan, N.J.
WALLACE WARREN WEBB, Gary, Ind.
JAMES QUILLA WRAY, JR., Baltimore, Md.
ROBERT ZONNEVELD, Surinam, Dutch Guiana.
HARVEY ALBERT ZORN, Cincinnati, Ohio.

Applying for Associate Member

ROBERT G. ARNOLD, Laramie, Wyo.
JOHN DOUGLAS BLACKBURN, Van Nuys, Calif.
RONALD IVER BLEWITT, Littleton, Colo.
AUBREY JEROME BOLES, El Centro, Calif.
CHUNG-CHOW CHENG, Kowloon, Hong Kong.
DONALD EDWARD CLEVELAND, New York, N.Y.
JOHN SAMSON NATHANIEL DANIEL, Cambridge, Mass.
ANTONIO LLEO DE LA VINA, Madrid, Spain.
ROY CLARENCE EDGERTON, Salem, Ore.
HJALMAR ANDREAS ERIKSSON, Stockton, Calif.
JOHN WILLIAM NORMAN FEAD, El Cerrito, Calif.
ERNEST GRANT FINGER, Indianapolis, Ind.
ISAAC GEORGE FORBES, Chicago, Ill.
FRANK SPURGEON FOSTER, JR., New Orleans, La.
CLARENCE ROBERT GLASSEY, Denver, Colo.
WILL MAYNARD HEISER, New Delhi, India.
MARVIN ELLSWORTH HERMANSON, St. Paul, Minn.
MICHAEL JOHN HOGAN, San Francisco, Calif.
GLENN EDGAR JOHNSON, New Orleans, La.
WILLIAM GEORGE KEAT, JR., Hartford, Conn.
HANS KOK, New York, N.Y.
WILLIAM WOLFGANG LORELL, New York, N.Y.
FRANCIS HEYWOOD MARSH, Harrisburg, Pa.
WILLIAM LAW OGILBY MARTINI, Glendale, Calif.
DONALD H. MILLER, Ithaca, N.Y.
KARIM WADI NASSER, Beirut, Lebanon.
DONALD CHARLES PHILLIPS, College, Alaska.
JAMES PINNELL, New York, N.Y.
TERRENCE LEROY ROBBINS, Juneau, Alaska.
CHARLES SARGENT, College, Alaska.
ROBERT EMMETT SCHADE, Cleveland Hts., Ohio.
NORMAN ROBERT SEDLANDER, E. Lansing, Mich.
IRVING SHERMAN, Los Angeles, Calif.
CLARENCE JOSEPH WELDON SMITH, JR., Augusta, Ga.
G. SUBHANI CHAUDHARI, Punjab, West Pakistan.
MINARD HUNTLEY WHITNALL, Ridgewood, N.J.
JAMES VALENTINE WILLIAMSON, Fairfield, Ill.
EUGENE JOHN ZIMMERMAN, Chicago, Ill.

Applying for Junior Member

WILLIAM HENRY ACKLIN, JR., Los Angeles, Calif.
SYDNEY KEITH ALEXANDER, Sheffield, Ala.
LOUIS ATTILIO ARATA, Daly City, Calif.
LUIS CUEVAS BARAJAS, Mexico, D.F.
WALTER GUSTAVE BELTER, Indianapolis, Ind.
JOHN CHARLES COLLINS, Baltimore, Md.
IRA GEORGE COTTON, San Diego, Calif.
DONALD LEE CRAWFORD, Kansas City, Mo.
JUAN CAYO de AZCARATE, Caracas, Venezuela.
RAJNIKANT THAKORBHAI DESAI, Oakland, Calif.
ROBERT LOUIS ECHOLS, Paducah, Ky.
MURRAY MARTIN GOLUB, New York, N.Y.
JAMES NORTON HAAS, JR., Seattle, Wash.
PAUL N. HARRAWOOD, Rollo, Mo.
HOWELL CARLISLE JONES, Augusta, Ga.
LEONARD KAPLAN, Urbana, Ill.
JAMES STEWART KILBURN, Los Angeles, Calif.
AHMED MOINULIAH, Madison, Wis.
MAE MASAKO NISHIOKA, Honolulu, T.H.
RIKIO NISHIOKA, Honolulu, Hawaii.
KEITH JACK NORMAN, Cambridge, Mass.
WILLIAM RUSSELL PARISSENTI, Los Angeles, Calif.
WILLIAM FRANCIS PILLSBURY, Sacramento, Calif.
JOSE IGNACIO SARMIENTO MUNEVAR, Denver, Colo.
NICHOLAS JOHN SCHNITTER, San Francisco, Calif.
ROBERT BUSH SNEED, Nashville, Tenn.
BRIAN WILLIAM STANLEY, Lancashire, England.
WILBUR DANIEL STITES, Rollo, Mo.
RICHARD WHITFORD SWANK, Boalsburg, Pa.
WALLACE FIER TATE, Baytown, Tex.
THOMAS BURTON WEBB, JR., North Augusta, S.C.

[*Applications for Junior Membership from ASCE Student Chapters are not listed.*]

Boeing offers a real creative challenge to engineers

This Boeing engineer is determining antenna properties that will influence the design of supersonic airplanes which still are in their preliminary study stage. This illustrates the variety and challenge Boeing offers in many fields: civil, electrical, mechanical and aeronautical engineering, mathematics and applied physics.

Emphasis at Boeing is on engineering excellence. Boeing engineers develop airplanes and guided missiles for jobs never done before, at altitudes and speeds never reached before. They work to closest tolerances of weight and space, using new materials like titanium and magnesium alloys, acrylics and plastics. If this challenge interests you, there is a place for you on a Boeing design, research or production team.

Recent Boeing developments like the B-47 and B-52 jet bombers, the IM-99 guided missile, and America's first jet tanker-transport are evidences of solid growth and engineering skill. New projects are already under way in widely diversified engineering fields: rocket, ram jet and nuclear propulsion, supersonic flight, guided missiles, research in new materials, and much more.

Boeing now employs nearly twice as many engineers as at the peak of World War II. And more engineers are needed. As a Boeing engineer, you will work with the most advanced equipment, like electronic computers, the world's most versatile privately owned wind tunnel, superb laboratories, and the huge new Flight Test Center.

You can be sure of individual recognition at Boeing as a member of a tightly knit "team." Promotions come from within the organization, after regular merit reviews. You will be encouraged to take graduate studies while working, and will be reimbursed for all tuition expenses.

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Co., Dept. 16-D, Seattle 14, Wash.

Please send further information for my analysis. I am interested in the advantages of a career with Boeing.

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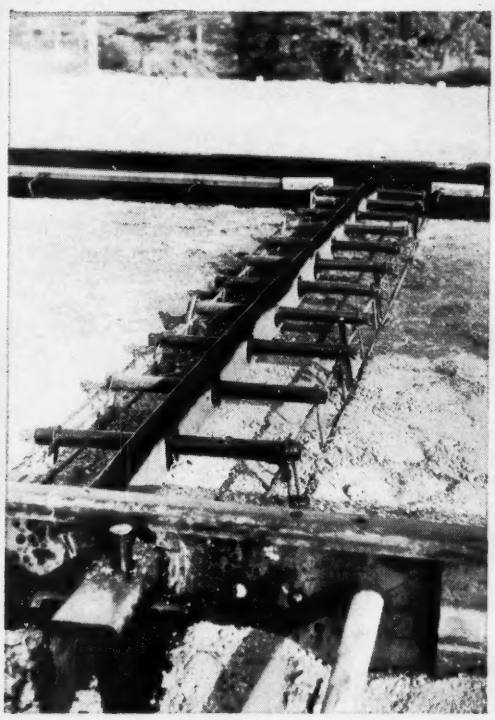

ROAD JOINTS LIKE THIS—147,000 linear feet of them—were shipped to the job site assembled. These joints were specially designed by American Steel & Wire, to assure a joint assembly with all members in proper alignment at all times.

CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

1 AERIAL MAPPING

Aero Service Corporation—Offers catalogs or literature covering new and more economical applications of varied aerial mapping services. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, airborne magnetometer surveys for ore and oil, and both plastic and plaster relief maps. Services discussed are used in highway design, plant engineering, industrial development, community planning, geological explorations and prospecting for oil or minerals.

2 AERIAL MAPPING

Jack Ammann Photogrammetric Engineers, Inc.—Announces two circulars, "A Turnpike Is Born" and "Photogrammetry in City Planning". The first deals with the topographic mapping of a turnpike location and explains the procedures followed to perform the extensive mapping required. The second article explains the value of photogrammetry in city planning operations.

3 AERIAL SURVEY AND MAPPING METHODS

Fairchild Aerial Surveys, Inc.—Aerial survey and mapping methods, particularly in relation to engineering and planning problems, are described and illustrated in "Focusing on Facts," available when requested on your business letterhead.

4 AIR LOCOMOTIVES

Eimco Corporation—Air locomotives for use by contractors on jobs where internal combustion equipment might not be desirable or where the proximity of inflammables or combustibles would make them dangerous are described in a bulletin. The claims include two-speed transmission constant mesh gearing and thereby haul twice the tonnage, twice the distance.

5 AIR MOTORS

Eimco Corporation—Air motors in various mountings and with geared heads of numerous output speeds in HP ratings from 7½ to 18 are described in two bulletins (L1026 and AE6001). Detailed drawing, specifications and photographs are also included.

6 ALUMINUM MILL PRODUCTS

Reynolds Metals Company—A 16-page brochure describing the mill products and how to use them has recently been published. Information is based on the industry's new alloy designation system. Also included is a complete wrought aluminum alloy selection guide.

7 AUTOMATIC MINE CAR COUPLERS

Mayo Tunnel and Mine Equipment—Bulletin No. 21 illustrates, with photos and drawings, a new automatic coupler for small mine cars which is designed to eliminate all the hazards of coupling and un-coupling by hand.

8 AUTOPOSITIVE PAPER

Eastman Kodak Company—This booklet features several companies which have used Kodagraph Autopositive Paper for drawing reproduction, revision and distribution. The booklet provides specific instances of the application of this photographic paper that prints directly to a positive, and that can be handled in room light. Another booklet, "Autopositive in Action", gives more reports from industry on this paper.

9 BELT CONVEYORS

Barber-Greene Company—Catalog 76-A (192 pages) describes a complete line of standardized, heavy duty belt conveyors for aggregates, coal, ore, mining use and general materials handling. Over 70 pages are devoted to job photographs and installation layout drawings. Each category of conveyor components, drives, truss, terminals, accessories, is treated separately with complete descriptions and specifications. An additional section gives engineering layout tables and specifications of various materials to aid in determining capacities, layout.

10 BITUMULS FOR BASE CONSTRUCTION

American Bitumuls & Asphalt Company—Offers a 12-page, two-color booklet, "Bitumuls for Base Construction," which is an illustrated and valuable guide on the modern methods and equipment for construction of stable, water-resistant bases for pavements. Various types of aggregates may be used, after proper laboratory classification in this method of construction.

11 BITUMINOUS FINISHER

Barber-Greene Company—A bituminous finisher for paving all types of "black-top" roads and airport runways is described in Catalog 879-A. A double-page, four-color spread illustrates the mechanical operation of the machine. Additional space explains, with diagrams, the finisher's principles of automatic leveling and its tamping, compaction-strikeoff action.

12 BLOWOFF EQUIPMENT

The Permutit Company—Bulletin 2319A takes cognizance of the fact that greater emphasis is being placed upon the value of recovering heat from boiler blowoff. Throughout the 12-page bulletin is a description of how the equipment successfully meets the demands of modern boilers. Furnished in four typical arrangements, the equipment provides economy of fuel, smaller quantity of blowoff, elimination of foaming and priming, reduction of make-up requirements, continuous blowoff and less strain on boiler metal.

13 BOILERS AND STOKERS

James Leffel & Co.—Have published bulletins describing the application and performance of the Scotch type boilers, oil fired, gas fired, coal fired. These bulletins contain interesting information on performance and efficiency.

14 BOLTING FOR STRUCTURAL JOINTS

Bethlehem Steel Company—There is a marked and growing trend toward the use of high-strength bolts in assembling structural members. Quickly

Mail This COUPON To-day

CIVIL ENGINEERING Date.....
33 West 39th St., New York 18, N. Y.
Please have the literature indicated by the circled Catalog Digest numbers in the April 1955 issue sent to me without obligation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32*	33	34	35	36*	37	38	39	40	41	42	43	44	45
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76*	77	78	79	80	81	82	83	84	85	86	87	88	89	90
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166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
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NOT GOOD AFTER May 15, 1955, for readers in the U.S., but requests will be accepted to June 30, 1955, from readers outside of this country.

Use This Free Service—Mail The Coupon To-day

CATALOG DIGESTS

installed by a two-man crew, high-strength bolts make possible substantial savings in time in steelwork erection. This company has published an illustrated booklet, "High-Strength Bolting for Structural Joints," which discusses this new method in detail, gives specifications and other useful data.

15 BORINGS

Raymond Concrete Pile Co.—A booklet "Subsoil Investigations for Foundations," Catalog B-5 explains the reason for subsoil investigations, what Gow borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

16 BRONZE CASTING ALLOYS

American Manganese Bronze Company—A 48-page booklet, called "Reference Book on Bronze Casting Alloys", gives general information on composition, characteristics, and applications of many of the common or typical alloys. It has an index of specification for common kinds of bronze castings and an index of applications and characteristics of bronze alloys in cast form.

17 CAST-IN-PLACE PILES

C. L. Guild Construction Co., Inc.—Has a descriptive folder on the COBI cast-in-place concrete piles. It illustrates how the piles are driven, poured and tested. The corrugated spiral shell is driven by a pneumatic mandrel expanded with 125 psi pressure. The company points out that the piles screw themselves into the ground, resisting both settlement and uplift. Another folder is available, which describes the use of the COBI pile on the New York Thruway.

18 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A new general catalog has recently been issued providing full details of weights and dimensions of "Sand Spun" Cast Iron Pipe and Cast Iron Fittings. This catalog also features "Mathews Modernized" and R. D. Wood Fire Hydrants, R. D. Wood Gate Valves and other products manufactured by this company.

19 CAST IRON PIPE

U. S. Pipe & Foundry Co.—Offers an 8-page booklet on U. S. centrifugally cast Roll-On Joint pipe for water, sewage or other liquids. It contains a table of dimensions and weights and illustrations showing progressive steps in assembly of Roll-On Joint.

20 CELLULAR FLOOR DRILL

Pennsylvania Drilling Co.—There is literature describing a portable drill for penetrating the concrete over cellular metal floor raceways for inserting the electrical fittings.

21 CEMENT GUN

Cement Gun Company, Inc.—Of considerable interest to the engineering profession is a 65-page booklet, designated as Bulletin 2400, describing the cement gun and its applications. It covers the principal uses of "Gunite" and is profusely illustrated. In the last few pages of this bulletin are typical specifications for various types of "Gunite" work.

22 CENTRIFUGAL PIPE

American Cast Iron Pipe Company—A book entitled "Large Diameter Mono-Cast Centrifugal Pipe" has been published by the mfgs. of Mono-Cast Centrifugal Pipe in dia. 2 in. through 48 in. inclusive. It has 53 pages and is illustrated. It is cloth bound and describes some installations of pressure lines in diameters up to and including 48 in. for gas, water, sewage, industrial wastes, chemicals and oils.

23 CHEMICAL FEEDER

Proportioneers, Inc.—New Bulletin 1910-3 describes a low capacity chemical feeder known as the "Chlor-O-Mite." It is a compact electrically and hydraulically operated diaphragm-type feeder. Specifically designed for controlled feeding of Hypochlorite or water treating chemical solutions into small water systems, operating at not over 25 gallons per minute and 50 pounds per sq in. pressure. All parts needed for the complete installation are furnished as a kit.

Return coupon on page 104

24 COILFILTER

Komline-Sanderson Engineering Corporation—Has available a bulletin on the Coilfilter, a modern vacuum filter. It describes how this filter is designed for modern sludge dewatering requirements. Outstanding features of the filter are defined as non-clogging, permanent filter media, constant output and low operating cost.

25 CONCRETE ADMIXTURES

Sika Chemical Corporation—Brochures describe Plastiment Retarding Densifier and Sikacrete Accelerating Densifier. Test data and specifications are included. Information on prestressed concrete, lightweight concrete, floating concrete structures, extra-duty concrete floors is also available.

26 CONCRETE CORE DRILL

Pennsylvania Drilling Co.—Literature is now available which describes a portable drill for penetrating masonry walls and floors through the use of diamond bits. It was primarily designed for use by plumbing and electrical contractors for running pipe and conduit through reinforced concrete.

27 CONCRETE CURING

Hunt Process Co., Inc.—A brochure explains the membrane curing method as the Hunt process. The four curing compounds, which are described in the booklet as clear, "tilt-up", black and pigmented, are just sprayed on concrete surfaces and allowed to work.

28 CONCRETE EQUIPMENT

Whiteman Manufacturing Co.—A copy of a multicolored booklet showing Whiteman concrete equipment is now available. Several units are shown in the line which includes Models M, B1, J1, and C4, Finishing Machines, Models DB-52 and FR-51 Power Buggies, Models GW, EW and SW Whiteman Vibrators (these are entirely new units now in production), and a new vibratory screed attachment, Model VSA.

29 CONCRETE HANDLING

Gar-Bro Mfg. Co.—Has published a check list for concrete handling and placing. The check list is composed of three sections: a specification check list, a job conditions check list and a summary list.

30 CONCRETE AND MASONRY CONSTRUCTION

Conver Steel & Wire Co., Inc.—A comprehensive 16-page catalog is now available, showing a complete line of concrete, masonry, lathing and carpentry accessories. In addition to well-known items such as form ties, spreaders, high chairs, several unique construction aids are described and illustrated: the "Simp-L-On" furring system; and descriptions and drawings of an assortment of hangers for suspended ceilings and solid plaster partitions.

31 CONCRETE PAVEMENT MANUAL

Portland Cement Association—This new 72-page illustrated manual gives details of geometric pavement designs and outlines the best methods of construction. It presents in summarized, usable form data on pavement layout and construction from recent technical society proceedings, engineering publications, field observations, tests and experience.

32 CONCRETE PIPE FOR IRRIGATION AND DRAINAGE

American Concrete Pipe Association—An official publication is available to engineers. It contains information on design of irrigation pipe lines, construction of irrigation pipe lines, methods of irrigating with concrete pipe lines and descriptions of various irrigation projects. This book is priced at 70¢.

N. B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.

33 CONCRETE SAWS

Clipper Manufacturing Company—The latest price list includes specifications on Masonry Saws, Wet or Dry Abrasive Blades, Diamond Blades and Break-Resistant Reinforced Blades. Specifications on "ConSawMatic" gasoline and electric powered Concrete Saws are also included as well as concrete cutting Diamond Blades and Clipper's "GreenCon" reinforced Abrasive Blade for green concrete.

THIS STRETCH of 9-foot wide Penetration Macadam shoulder will be given a Double Surface Treatment.

Bitumuls 3" Penetration Macadam for Heavy Duty Shoulders on West Virginia Turnpike

Bitumuls and a Specially-Built Compactor Team Up to Provide Maximum Stability

On a heavily traveled 30-mile section of the West Virginia Turnpike, safety and utility demanded the addition of a nine-foot shoulder. To provide a pavement-extension of maximum stability, Penetration Macadam with emulsified asphalt was specified.

Special Compactor

A special "articulated" compactor, designed for this particular job, was made up in two-foot sections to provide adequate flexibility for full-width compaction without rideover. This compactor gives maximum void filling, but Bitumuls easily penetrates down through the stone forming thin asphalt films that allow fractional contact of the graded stone thus assuring maximum stability.

Methods of Construction

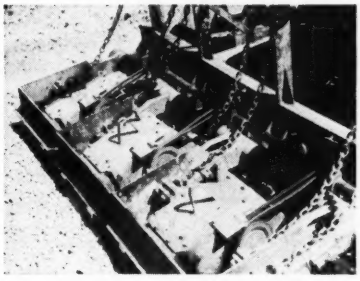
Base stone 2½" to 1" in size was placed at 210 lbs per sq. yd., rolled lightly, then choked with ½" to No. 8 chips, using the special compactor.

Bitumuls RS-1 was then applied at the rate of 0.25 gals/sq. yd., followed by a cover of ½" to No. 8 stone chips at 40 to 50 lbs per sq. yd. This cover aggregate was rolled with an 8-ton tandem, and a second application of Bitumuls RS-1 applied at 0.8 gals per sq. yd. Cover aggregate was again spread at 18 lbs per sq. yd.

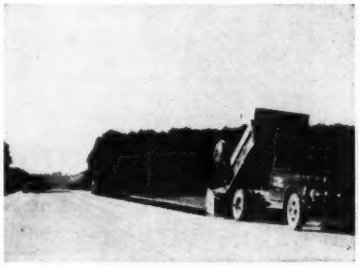
The surface was then given a Seal Coat of 0.5 gals per sq. yd. of Bitumuls RS-2 followed by imported limestone chips at 15 lbs per sq. yd. The final step in sealing the shoulders was a second Seal Coat of 0.25 gals per sq. yd. of Bitumuls RS-2, with the final cover of ⅜" to No. 10 chips at 10 lbs per sq. yd. This Seal Coat was then given a final rolling.

Bitumuls Field Engineers from our office nearest you will be happy to supply specifications on this or other types of paving.

Illustrated booklets on *all* types of Bitumuls construction and maintenance work are also available.



CLOSE-UP of the specially-designed "articulated" compactor showing the individual 2-foot sections.



SURFACING AND SEALING operations, Distributor applying Bitumuls (center) is followed closely by cover-aggregate truck. An 8-ton tandem was used to roll the cover aggregate.

AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH STREET · SAN FRANCISCO 4, CALIFORNIA

E. Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Mobile, Ala. Cincinnati 38, Ohio Columbus 15, Ohio Tucson, Ariz. Seattle, Wash. Baton Rouge 2, La. St. Louis 17, Mo. Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore. Washington 5, D. C. San Juan 23, P. R.

34 CONCRETE SAWS

Eveready Briksaw Company—Prices and specifications on all products are given in the Folder No. 102. This includes Masonry Saws, Concrete Saws, Blades and a Dust Control Unit for use when cutting dry with the masonry saw. A booklet, "How to Cut Blade Costs in Masonry Cutting," is also available.

35 CONCRETE PIPE

Cen-Vi-Ro Pipe Corporation—The second edition of the brochure on reinforced concrete pipe includes information on the improvements in the process. Based on experience in the manufacture handling, testing, transportation and installation of reinforced concrete pipe, the booklet presents many pictures with informative captions indicating the progress in its use on major projects. There is also a four-page bulletin giving specifications and diagrams of the actual pipe.

36 CONCRETE PIPE HANDBOOK

American Concrete Pipe Association—This handbook contains 384 pages on the manufacture and use of concrete and reinforced concrete sewer and culvert pipe. Discussion of Marston's Theory and maximum and minimum allowable depths of fill is presented along with examples and tables. A thorough, comprehensive discussion of the use of concrete pipe in sewers and culverts is included. Appendix contains A.S.T.M. and AASHO specifications. Price $4.00.

N. B. There is a charge for this book. Make checks payable to The American Concrete Pipe Association.

37 CONCRETE PRESSURE PIPE

Price Brothers Company—Offers a new 24-page booklet "The Story of Concrete Pressure Pipe" that explains manufacturing, prestressing, laying and tapping of concrete pressure pipe. It contains a catalog of types of Price Pipe, list of specials and information on the flexible watertight joint. This factual, illustrated book is valuable for engineer, contractor and layman.

38 CONCRETE SEWERS

Portland Cement Association—This 48-page booklet describes the advantageous use of concrete in sewer construction. The introduction includes a brief history of sewers and early use of concrete sewers. Other chapters are devoted to hydraulic and structural design and construction, maintenance and repair. It is well-illustrated with photos, charts, tables and graphs.

39 CONSTRUCTION EQUIPMENT

Gar-Bro Mfg. Co.—This company's equipment, designed for concrete and materials handling, includes more than 300 items. The primary types are illustrated and presented in this Catalog No. 97. From wheelbarrows to the 8-cubic yard concrete bucket, the products are pictured in the catalog.

40 CRANE RUNWAY RAILS

L. B. Foster Company—Specifications and other engineering data on crane runway rails and accessories are included in literature entitled, "Crane Runway Rails and Accessories". Among the accessories described are: crane rails, angle bars, crane stops, rail clips, bolts, hook and anchor bolts, bearing plates. The literature also contains specifications and general information concerning the various sizes of crane rail clips.

41 CONVEYORS

Link-Belt Company—Trukveyors, a dragline conveying medium designed to reduce the unit cost of materials handling in warehouses, truck and railroad terminals, are described in detail in a 24-page illustrated book. Book 2497 describes both the overhead and in-the-floor types of Trukveyor.

42 CRAWLER TRACTOR

Allis-Chalmers Manufacturing Company—A 16-page color catalog describes the HD-9 diesel-powered crawler tractor. Shown are features of its diesel engine and various components of the tractor. It is an 18,800 pound crawler that is rated at 72 drawbar h.p.

43 CRAWLER TRACTOR

Allis-Chalmers Manufacturing Company—Action pictures and mechanical views of the HD-5 diesel-powered crawler tractor with a rated 40 drawbar h.p. feature in the 24-page color catalog of this tractor. It powers a variety of allied attachments, some of which are shown.

44 CURING BLANKETS

American Sisalkraft Corporation—On-the-job photographs show how-to-do-it in this booklet devoted to the Sisalkraft Method of curing and protecting roads. Two methods are shown in the use of the waterproof paper for curing concrete.

45 DEPTH RECORDER

Edo Corporation—A well-illustrated pamphlet explains the precision survey depth recorder. This recorder, Model 255, measures the depth of water for survey purposes and presents in permanent form an accurate record of the water's depth. A specifications chart is included in the brochure.

465 Highway Miles Mapped in 75 Days

AERO methods speed planning for Illinois Toll Road System

In just 75 days, AERO has completed America's largest single highway mapping project—the 465 mile, five-road system planned by the Illinois Toll Road Commission.

The speed of the AERO camera, combined with modern stereoplotting instruments, has once again slashed highway mapping costs, cutting schedules to a fraction of the time required for ground survey methods.

Air photos point the way

AERO crews swiftly flew the area, delivering air photos of possible routes without setting off premature land speculation. These photos were studied by Joseph K. Knoerle & Associates, Chicago—consulting engineers in charge. Preliminary routes and alternate route selections were made, and center lines were delineated on the pictures.

Topographic maps with a deadline

Then AERO mappers swung into action. Topographic maps were prepared for route strips 1,000 feet wide on either side of the center lines—wider at interchange locations. These precise *5 ft.* contour maps, accurate to within ½ contour interval, were rushed so that final engineering plans could be presented to the governor and interested officials.

The skilled manpower and complete mapping facilities which advanced the ground breaking date for this projected $583,000,000 Illinois turnpike system demonstrates how AERO methods can speed the vast highway programs now being planned by many States.

Cut mapping costs

AERO highway mapping experience in more than 20 states now totals several thousand miles. On one recent project, turnpike engineers estimate AERO maps were delivered five times faster than ground survey methods, and at only one-fifth the cost.

When you're planning a highway, it will be well worth your while to call AERO in the preliminary planning stage. Our engineers will be glad to meet with you.

AIRBORNE MAGNETOMETER SURVEYS
PRECISE AERIAL MOSAICS
TOPOGRAPHIC MAPS
PLANIMETRIC MAPS
RELIEF MODELS
SHORAN MAPPING

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CATALOG DIGESTS

46 DESIGN EXTRACTS—SHEET PILING

United States Steel Corporation—A 50-page book ADV-18605, contains comprehensive design data concerning steel sheet piling. The material in this book was taken from the publication "Carnegie Steel Sheet Piling," which, when first published during the early 1930's, was one of the first handbooks available on the subject.

47 DESIGN OF CONCRETE AIRPORT PAVEMENT

Portland Cement Association—This 48-page booklet on the design of concrete pavement for airports presents design charts for determination of pavement thickness and concrete resurfacing. Also included are recommendations for jointing layout, the use of subbase under concrete and the evaluation of existing pavements.

48 DIESEL EQUIPMENT

Caterpillar Tractor Co.—Machines that are capable of handling a variety of jobs all-year-round and still are capable of emergency snow removal when storms strike is the main point of the pamphlet "Clearing the Way—to Lower Costs". The versatility of such machines as the Cat #12 Motor Grader, Cat D6 Tractor and attachments such as HT4 Shovels and Bulldozers, Snow Wings, Snow Blowers, Snow Plows is discussed and illustrated.

49 DRAFTING MACHINES

V. & E. Manufacturing Co.—Has issued a new 15-page brochure giving detailed descriptions of such drafting machines as the Vertical Drafter, Detail Drafter, Left-Handed Drafter, and Formed & Solid Drafting Machine Scales. Information on how to select the proper size machine will be helpful to engineers and draftsmen. Also included is a price list.

50 DITCH PUMPS

Byron Jackson Co.—A short brochure explains the single-stage vertical pumps which are for irrigation, drainage, canals, lakes, rivers. A selection chart with specifications is included.

51 DRAG SCRAPERS

Sauerman Bros., Inc.—Bulletin No. 160, "Long Arms for Your Tractor", includes tables which give line speeds, capacities and recommended horsepower of tractors for the various sizes of Sauerman buckets. Field Report 209 shows how a scraper powered by a two-drum hoist mounted on a tractor can work in places which allow none of the head room or surfaces other machines require. Field Report 219 shows how to make a dragline reach farther and dig more.

52 DRAINAGE PRODUCTS

Armco Drainage & Metal Products, Inc.—The use of this drainage equipment in jobs throughout the country is illustrated in a colored folder. A data sheet listing the drainage structures is included.

53 DRAIN GRATES

Irving Subway Grating Co. Inc.—A recently published 4-page, two-color folder illustrating the use of open mesh steel flooring as drain grates has been published. The folder contains photographic illustrations, exemplary application of drain grates (as much as 90% open). There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

54 EFFECTS OF CALCIUM CHLORIDE

Solvay Process Div., Allied Chemical & Dye Corp.—Has prepared a 40-page, semi-technical booklet of interest to architects, engineers and others concerned with specifications, design or production of Portland cement concrete. This booklet contains tables, graphs and charts covering setting time, early strength, curing, slump,

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CATALOG DIGESTS

density, surface wear, shrinkage and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air-entraining, high early strength and low heat cements.

55 ELECTRONIC FISH CONTROL

The Electric Fish Screen Company—Offers an illustrated pamphlet describing a new design in Electronic Pulse Generators, used in connection, with their Electric Fish Screens. This equipment requires virtually no servicing, and its operation is entirely automatic. It is not sensitive to weather conditions, and can be adjusted to compensate for various water velocities, conductivity and species of fish encountered.

56 ENGINEERING TEXTBOOKS AND REFERENCES

The Ronald Press Company—Described in a special brochure is a selected list of current technical books of special interest to the engineer. These authoritative and up-to-date references and textbooks cover many important aspects of structural analysis, design, engineering economy and management.

57 FIBRE FORMS

Sonoco Products Company—Sonotube Fibre Forms, as explained in this recent brochure, were developed to provide an economical method of forming round columns of concrete. The pamphlet shows photographs of actual job applications of the forms.

58 FILTER

Eimco Corporation—There is a booklet offered on a completely new plate and frame filter composed of two sets of frames mounted at 180° on a central shaft and revolving on said shaft between one row of plates. Advantages claimed are faster opening and closing and complete elimination of down time as the loaded frames are revolved out in the open to be cleared while the other frames are on the line. This booklet, known as the Burwell Filter Bulletin (F-2035), is complete with colored diagrams and specifications.

59 FLOOR CATALOG

H. H. Robertson Company—This catalog contains description, technical and structural details showing advantages through use of cellular steel structural sub-floor. It illustrates easy electrical access to any 6 in. square of exposed floor area and shows the saving in foundation and structural steel.

60 FLOOR GRATINGS

Borden Metal Products Co.—A catalog containing technical information on how to select, design, purchase and install floor gratings, safety steps, floor armor is offered. Safeload tables, step-by-step procedure for ordering, planning and checking, is included.

61 FOUNDATION PILES

Franki Foundation Company—Has a profusely illustrated, 12-page brochure that describes in detail the Franki methods of forging concrete foundation piers into the soil with driving weight blows of 200,000 feet pounds. The colorful bulletin also shows the Franki method for densification of soil by intrusion and the procedure used for concrete-filled pipe. Requirements for design are also given, together with test data on representative jobs throughout the world.

62 FOUNDATIONS

Drilled-In Caisson Corporation—Literature describes foundation columns anchored in rock sockets; heavy column loads carried on single caissons; penetration through any type of soil to rock at any depth; examination of rock can be made; economy in time and labor; foundation bonded in rock; description, design, specifications, technical data.

63 FOUNDATIONS

Spencer, White & Prentis, Inc.—Has literature on the construction of difficult and unusual foundations, description of concrete-filled steel tubes driven to rock, including technical data, performance and installation, description of Pretest Underpinning and the application of the Pretest Method.

64 GEARS AND OPERATING MACHINERY

The Earle Gear & Machine Co.—A new bulletin describes products, facilities and designing services: gears of all types in all practical materials; other products closely related to the manufacture of gears, such as racks, sprockets, sheaves and special machinery of which gears form a part. Also includes a table of gear formulas with related blue print references; ordering information and a few installation photos to illustrate the wide applications of products.

Send coupon on page 104

65 GLASS INSULATION

Pittsburgh Corning Corporation—Has published a 12-page brochure, "Foamglas in Thin Wall & Sandwich Panel Construction." In addition to information on the specific advantages of Foamglas cellular glass insulation for this type of construction, the brochure contains photographs and details of important projects utilizing this technique. Fabrication and job data accompany each project.

66 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—Just published its new Catalog F400, containing illustrations, descriptions and complete engineering data on grating flooring, treads and floor armoring (riveted, press-locked, welded types)—safe, durable, fireproof, ventilating, clean and economical—for industrial and power plants and refinery walkways, stairways, driveways, trucking aisles.

67 GRAVITY FILTERS

The Permutit Company—Bulletin 2539B describes in its 24 pages the complete line of gravity filters and filter accessories, manually operated, semi-automatic, including operating tables, rate of flow controllers and gauges. Specifications, operating instructions, outline dimensions and typical installation photographs have been included in this new edition.

68 GUNITE

Pressure Concrete Company—Has a 48-page illustrated, free booklet on Gunite in all of its phases. The booklet contains specifications, job stories and illustrations showing Gunite repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks and bunkers. The booklet also contains photographs on new prestressed tank construction and much other data. A new leaflet just published illustrates pressure grouting to dams.

69 HAND LEVER DRILLS

Acker Drill Co., Inc.—Acker Bulletin 21 describes both Acker LD and LLD hand lever feed core drills for foundation test drilling, highway test cores, moderate depth mineral prospecting.

70 HANDLING AND STORAGE OF CHEMICALS

Sauerman Bros., Inc.—New Brochure, "MMM No. 2," shows how Sauerman engineers develop storage systems to meet the needs of the bulk chemicals industry and work with consulting engineers and plant designers to fit scraper storage into the building plans. A variety of installations are shown as well as many layout drawings and photos.

71 HEAVY DUTY MOTOR OILS

Standard Oil Company (Indiana)—A 12-page illustrated booklet covering the history and development of Standard's heavy-duty motor oils is available. This bulletin reviews the performance requirements of heavy duty motor oils and defines the new A.P.I. service classifications.

72 HEAVY DUTY TRAILERS

Birmingham Manufacturing Company, Inc.—A bulletin giving specifications and photographs of trailers that average from 15 to 35 tons is offered by this Southern company. The several models are pictured and both standard and general specifications are presented. Although a variety of trailers is manufactured, all standard units have flat gooseneck and straight deck.

73 HIGHWAY EQUIPMENT

Buffalo-Springfield Company—Offers two catalogs, one on the K-45 Kompactor, a revolutionary compaction machine that is claimed to exceed density requirements in 50 per cent fewer passes. The other catalog features and describes the 3-axle tandem roller which uses an exclusive "walking beam" principle.

74 A HISTORY OF CAST IRON PIPE

Cast Iron Pipe Research Association—A third edition of the booklet "Service Records of Cast Iron Mains Laid in the 17th, 18th and 19th Centuries", has just been published. It contains photographs of uncovered old pipe still in service, a digest of "Survival and Retirement of Cast Iron Water Mains in 25 Cities" excerpted from the book published by American Water Works Association, and a list of the 67 members of the Cast Iron Pipe Century Club.

75 A HISTORY OF ROADS

American Association of State Highway Officials—Offers a two-volume edition, "Public Roads of the Past," Volume I, and "Historic American Highways," Volume II, of the history of roads, methods, instruments and influences. Both volumes have complete bibliographies, illustrated with both maps and sketches. Volume I is the European phase, from earliest recorded history (about 3500 B.C.) thru rise and fall of Roman Empire, discovery of New World, to 1800. Volume II is the record of transportation development in America. Price is $3.00 for Volume I and $4.00 for Volume II, or $6.00 per set.

N. B. There is a charge for these books. Make checks payable to American Association of State Highway Officials.

76 HYDRAULIC DATA BOOK

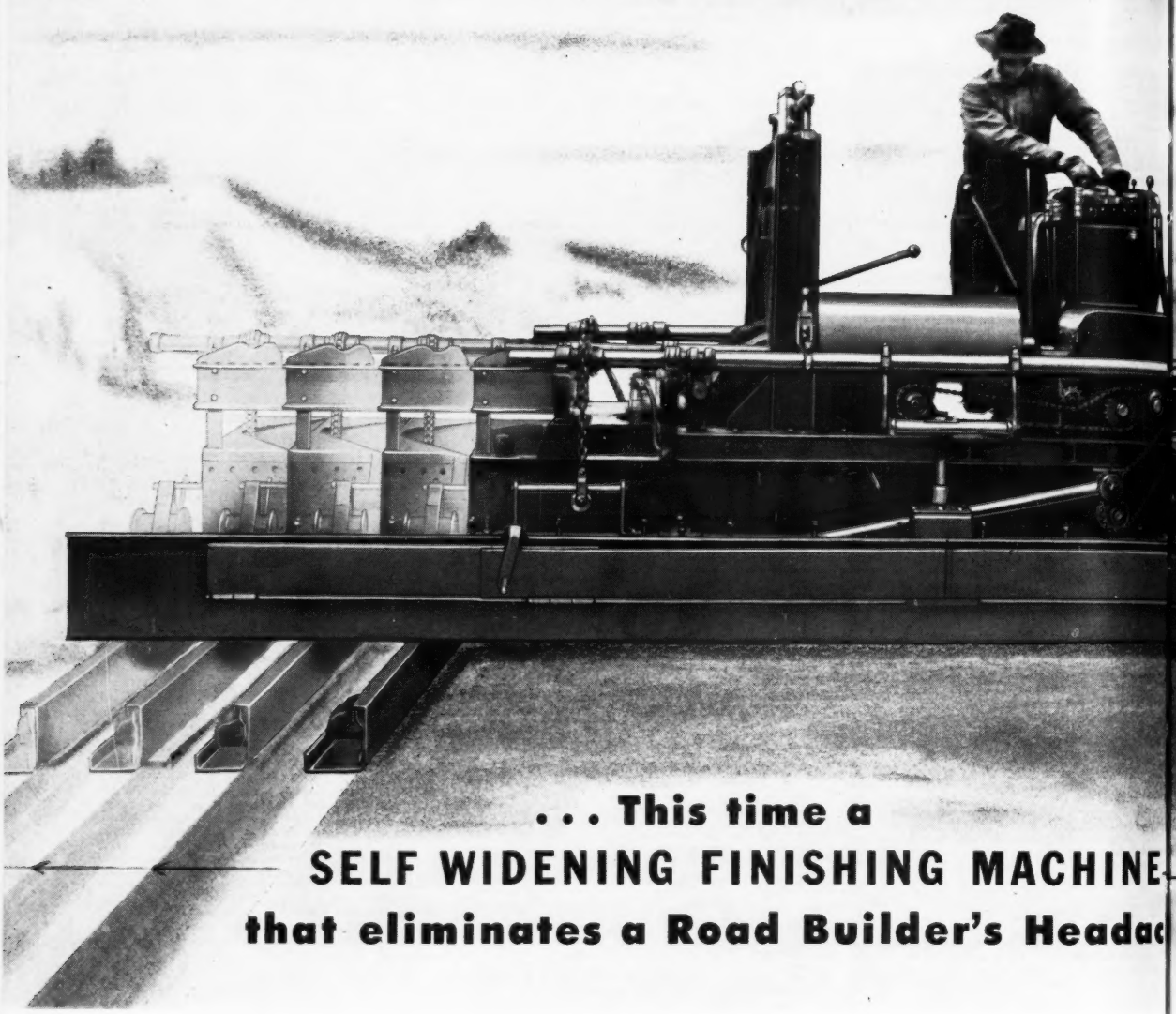
Leupold & Stevens Instruments, Inc.—Interpretive data on water measurement and control is at your fingertips in the 144-page revised edition, in three parts: Float Wells and Instrument Shelters; Errors in Float Operated Devices; Hydraulic Tables; plus pages for notes and memorandums. Indispensable for the engineer with its wealth of information, tables, charts and illustrations. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to Leupold & Stevens Instruments, Inc.

77 HYDRAULIC AND PNEUMATIC CONTROLS

Barksdale Valves—A catalog develops in detail four types of valves which the company features: manual valves, solenoid valves, solenoid pilot controlled valves and pressure switches.

It's FLEX-PLANE ga



. . . This time a SELF WIDENING FINISHING MACHINE that eliminates a Road Builder's Headac

Now, for the first time, a mechanical finishing machine will widen with a flick of a finger. What does this mean to road builders? Hundreds of hours saved in finishing interchanges, intersections, passing areas, pull-off areas or wherever the width of a highway varies.

Simply set your forms to follow the actual path of the finished roadway, pour your concrete and the Flex-Plane Self-Widening Finisher will do the rest. It's a completely new idea — *the frame widens — not the wheels.* A specially designed triple-lap frame gives the machine utmost rigidity even when completely expanded.

It's a real work horse that gives the finished roadway greater uniformity, reduces hand labor to an absolute minimum, permits the finish of wide and variable width areas without special form set-up and pouring operations. It's the greatest innovation in concrete finishing in recent years. Naturally, it can be used as a standard straight-line finisher, and with an extra wide range of widths.

Like so many other cost-reducing developments, the self-widening feature is found only

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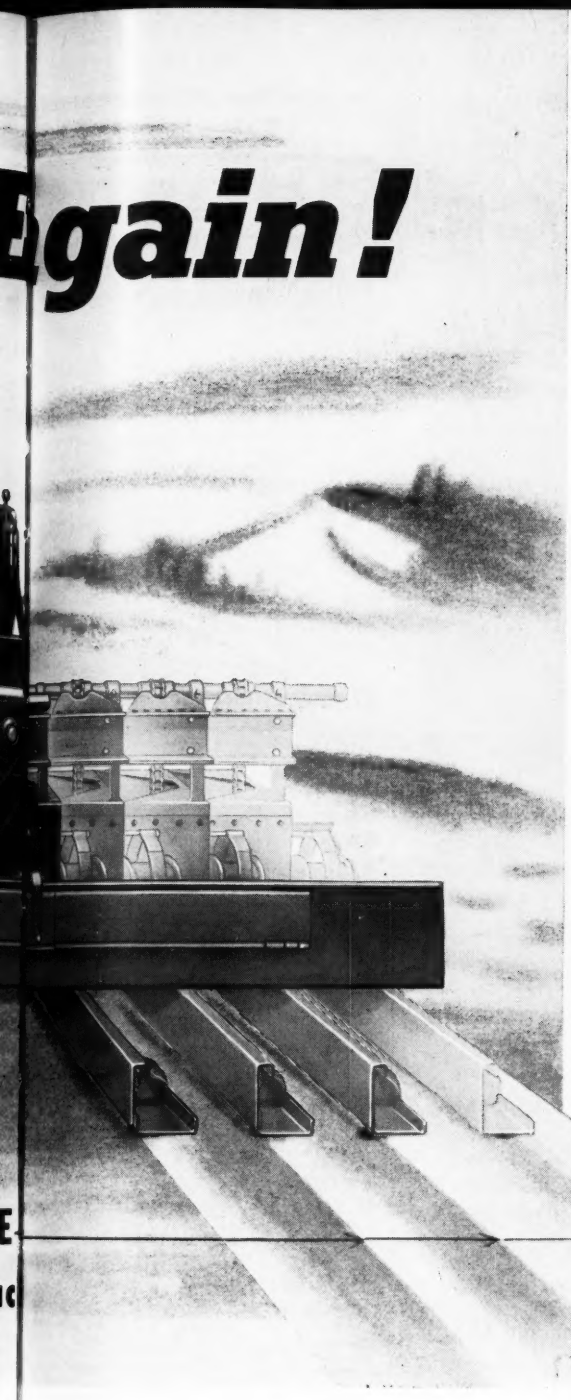
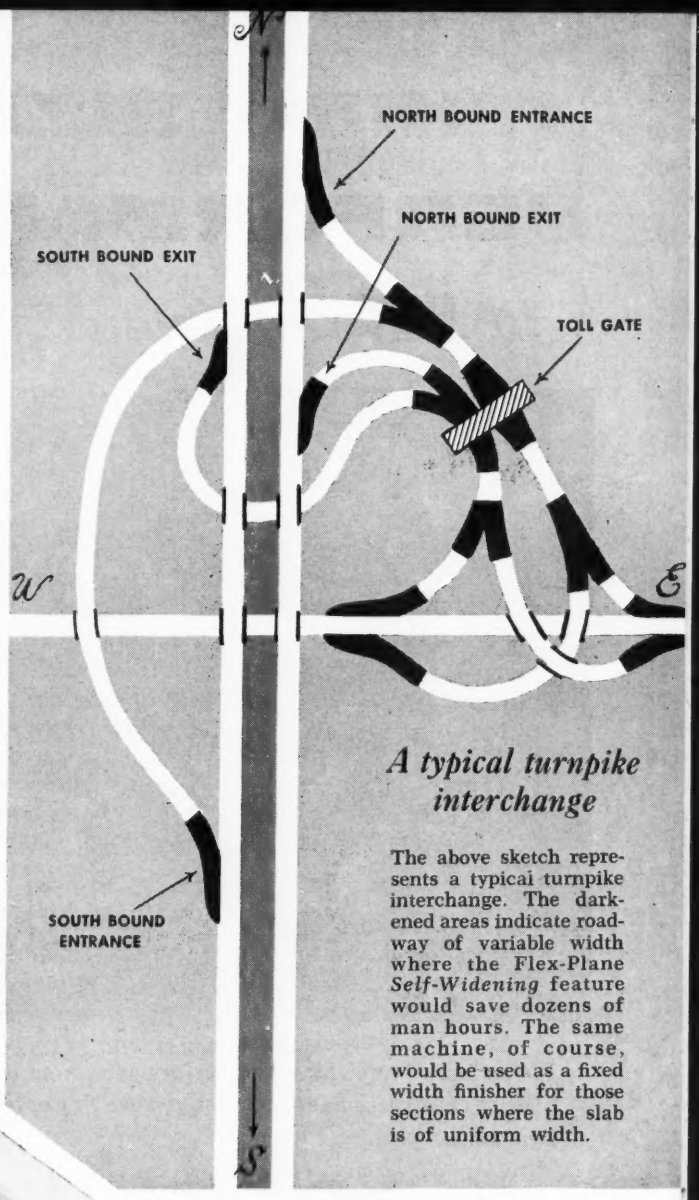




A typical turnpike interchange

The above sketch represents a typical turnpike interchange. The darkened areas indicate roadway of variable width where the Flex-Plane *Self-Widening* feature would save dozens of man hours. The same machine, of course, would be used as a fixed width finisher for those sections where the slab is of uniform width.

on Flex-Plane Finishing Equipment. In fact, it's this kind of forward thinking that has made Flex-Plane the world's largest producer of concrete finishing machines. And it's the reason why you should talk with Flex-Plane before buying finishing equipment of any kind.

THE FLEXIBLE ROAD JOINT MACHINE COMPANY
WARREN, OHIO

The Flexible Road Joint Machine Co.
3400 Thomas Rd. Warren, Ohio

Please send me latest information on the Flex-Plane Concrete Finishing Machine Line.

Name_____

Title_____ Company_____

Address_____

City_____ State_____

THE NATIONAL STEEL FORM AND IRON Heltzel BUILDS IT WARREN, O.

THE FLEXIBLE ROAD JOINT MACHINE COMPANY Flex-Plane MECHANIZED CONSTRUCTION EQUIPMENT WARREN, OHIO

INISHING EQUIPMENT

CATALOG DIGESTS

78 HYDRO-FOIL PUMPS

Peerless Pump Division—Explaining the propeller type pump and the mixed flow pump, this catalog illustrates the pumps in their various jobs. Huge volumes of water may be pumped to or from desired areas with these units.

79 INCINERATOR STOKERS

Flynn and Emrich Company—Bulletin No. 1702 fully describes a proved design of automatic stokers for municipal and industrial incinerators. The bulletin clearly shows the design and operation of this simple, rugged and dependable incinerator stoker that has proved itself in the field. The bulletin also includes an up-to-date history of incineration.

80 INCOME PROTECTION FOR MEMBERS

Smith & Sternau—A pamphlet giving full details on the societies' groups disability plan outlines the moderate rate and its many advantages and benefits. Specify membership grade on coupon.

81 INDUSTRIAL AND MUNICIPAL WATER

Ranney Method Water Supplies, Inc.—Have available a 20-page illustrated booklet describing Ranney horizontal water collectors and their advantages in the development of large supplies of clear non-turbid water for municipalities and industries. It is called "Industrial and Municipal Water" and may be obtained upon request.

82 INDUSTRIAL PRODUCTS

Johns-Manville—A new edition of their 40-page Industrial Products Catalog which offers essential data on the following groups of products: Insulations, Refractory Products, Asbestos Cement Pipe, Packings, Gaskets, Electrical Products, Frictional Materials, Roofing, Siding, Flooring, Partitions and Ceilings. Photographs, diagrams and text have been revised and brought up-to-date so that engineers and plant executives will have the latest information in a compact catalog that is easy to use.

83 INDUSTRIAL SERVICE PUMPS

Peerless Pump Division—There is a bulletin (B-505) which describes three models of industrial service pumps: standard, heavy-duty and special service types. The work of these pumps applies to cooling tower service, tank pumping, line pumping, process and chemical pumping, and other functions.

84 JETTING PUMPS

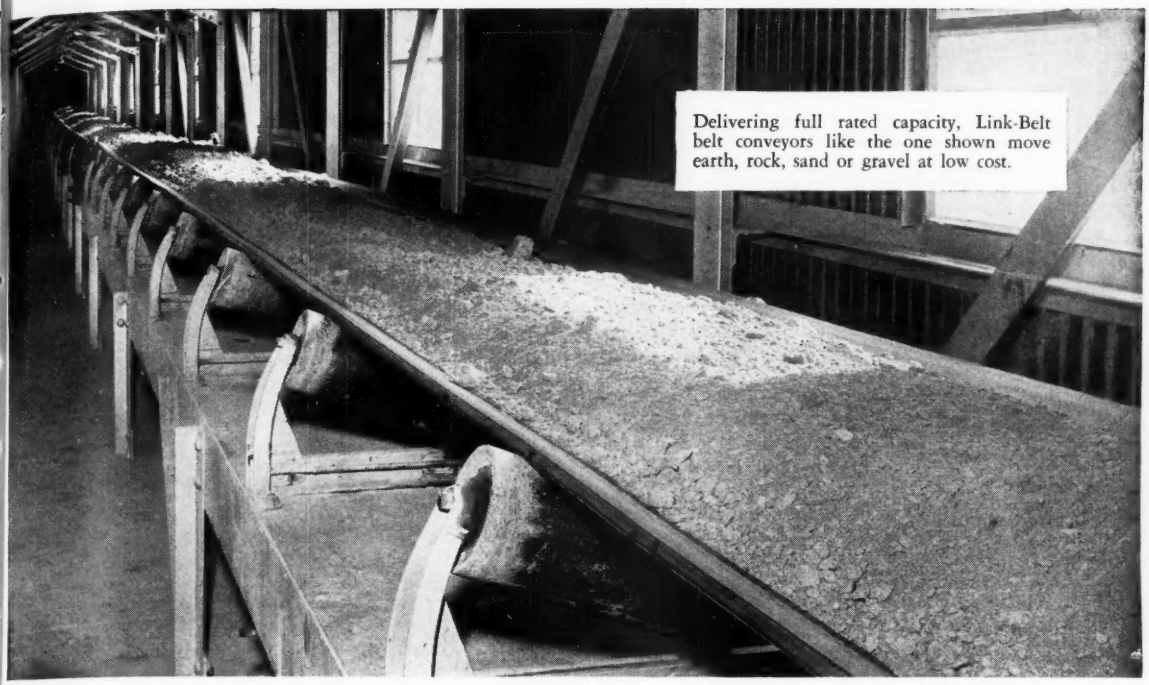
Griffin Wellpoint—A booklet illustrates jetting pumps for pile and caisson jetting, oil pipe line testing, water supply, fire protection. The illustrations show unusual set-ups for high-pressure jetting, including parallel and series pumping arrangements. The units included range from 200 to 1400 g.p.m. with pressures from 100 to 700 lbs. per sq. in.

85 JOBS FOR ENGINEERS

Lockheed Aircraft Corporation—This well-known airframe company makes an attractive appeal to engineers to join Lockheed in a booklet entitled "Your Future Is Now—with Lockheed in California". The literature states that the diversified production and the diversified project development make for security and stability of employment. It illustrates the several divisions of Lockheed and it concludes with a picture of Utopian living in California.

86 JOINT SEALER

Sika Chemical Corporation—A brochure describes flexible non-meltable Igas joint sealer for water reservoirs, concrete tanks and deep basements. Specifications and architectural details are included on separate sheets.



Delivering full rated capacity, Link-Belt belt conveyors like the one shown move earth, rock, sand or gravel at low cost.

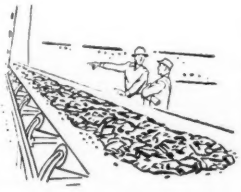
SURE ROAD TO LOWER HANDLING COSTS

... carry the load via Link-Belt belt conveyors

LINK-BELT offers you the "total engineering" so necessary for top efficiency

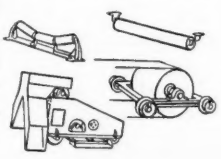
DESIGNED FOR OVERALL EFFICIENCY—Because of its unrivaled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit individual conveyors into your overall system requirements for best results.

DELIVERS FULL RATED CAPACITY—Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews at the customer's request.



ASSURES SATISFACTORY PERFORMANCE—When you rely on Link-Belt as a single source for your complete system, we accept responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems. For all the facts call your nearby Link-Belt sales representative.

BUILT FOR LONG-LIFE PERFORMANCE—Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the specific job.



LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,400

CATALOG DIGESTS

87 LETTERING MACHINE

Ralph C. Coxhead Corporation—The Vari-Typer engineering lettering machine relieves draftsmen from tedious hand lettering. The machine operates like a typewriter, but has instantly changeable type faces in different styles and sizes to meet the various needs of the tracing or bill of material. The carriage is designed to hold tracings as much as 6 ft or more in width. The type impressions are electrically controlled, producing a uniform, sharp, black character so important to a good tracing. Mathematical symbols as well as draftsmen style lettering are available in the changeable type for cartridge.

88 LIFT TRUCK

Wm. Bros Boiler & Mfg. Co.—A folder on the Bros Lectro-Lift Material Handling Truck Body shows how it operates and why it is especially adaptable to handling concrete blocks and similar materials.

89 MAGNESIA INSULATION

Johns-Manville—A 12-page illustrated brochure tells how 85% Magnesia is produced, explains why it has high insulating value, points out where it can be used to advantage and goes into detail about special characteristics such as strength, water resistance and appearance. The brochure covers both pipe and block insulation. In tabular form, it gives data on physical and thermal properties.

90 MASONRY CEMENT

Lone Star Cement Corporation—A 16-page, illustrated booklet outlines the advantages of Lone Star masonry cement in simplifying the problem of obtaining uniformly high-quality mortar, as well as the economy of one rigidly standardized, ready-to-use cementing material instead of two with no lime or portland cement to add, and no soaking or slaking. It provides timely information on soundness, low absorption, high water repellency and other factors contributing to durable, weather-resistant performance. It contains easily-read graphs showing effect of mix proportions on water retention, strength and absorption, effect of mixing time on water retention, along with convenient reference tables for estimating quantities.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

91 MATERIAL SPREADER

Essick Manufacturing Company—A four-page leaflet containing pictures, specifications and operating features of a material spreader is now available. The Model 710 Spreader operates as a fine-grader, after the area has been rough graded.

92 MEASURING WHEELS

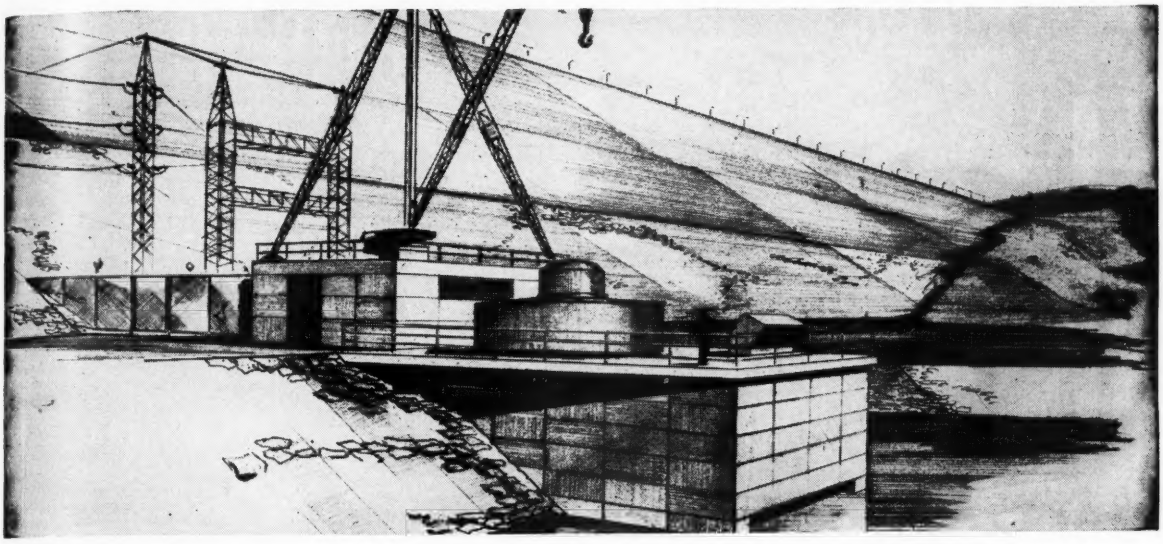
The Maintenance Co., Inc.—Attractive, free folder describes how one man using a Mainco Distance Measuring Wheel can do a better, quicker job than two men using chain or tape. Sturdy, accurately built, yet it weighs only 5½ pounds. Mainco Wheels have been serving and saving money for contractors, engineers, utilities for over 25 years. Repeat orders by same companies is proof of satisfaction. Folder also offers unconditional two weeks free trial.

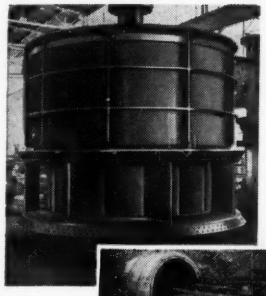
93 MEASURING WHEELS

Rolatape, Inc.—Offers descriptive literature No. 24 on their line of measuring wheels. The information discusses fully and illustrates the

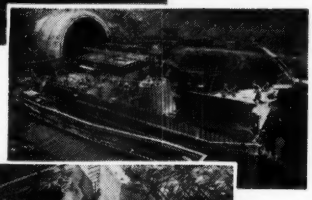
TVA Chatuge Dam Power Plant Installs LEFFEL Hydraulic Turbine

a progress report at the beginning of 1955

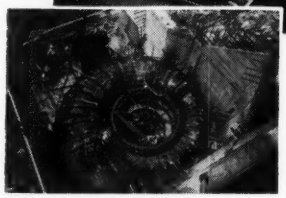




Completely assembled turbine except for riveted scroll case.



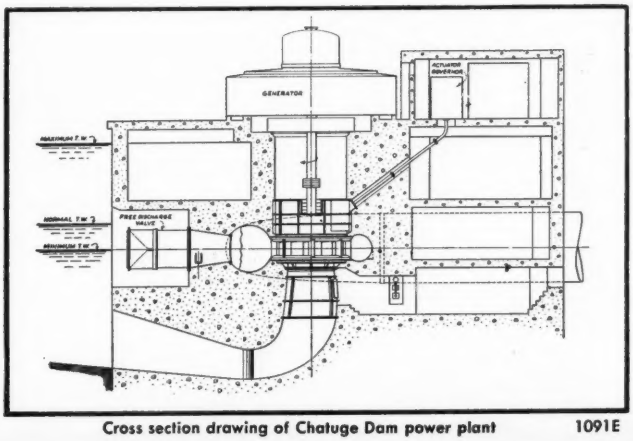
Powerhouse evacuation and draft tube floor with forms in place.



Assembled scroll case in position from above.

In the new power plant at Chatuge Dam, a Tennessee Valley Authority earth-fill dam near Murphy, North Carolina, another efficient hydraulic turbine installation by Leffel is being completed. The turbine is rated at 13,800 H.P. under a head of 100 feet at 180 R.P.M. A photographic progress report of the installation is shown here.

All over the world Leffel hydraulic turbines harness water power economically and efficiently. Why not let us help you with your project, whether it be expansion, rehabilitation or a new installation? Please write, wire or phone for further information.



Cross section drawing of Chatuge Dam power plant 1091E

CATALOG DIGESTS

economy, utility and accuracy of measuring as one walks, a one man operation. It shows how to extend the handle, set the counter at zero and begin to measure. There are three size wheels, numbered according to their diameter: Models 200, 400, 600.

94 MINE HAULAGE EQUIPMENT

Mayo Tunnel and Mine Equipment—Four-page Bulletin No. 18-a gives complete information in charts, photos and drawings of compressed air locomotives, muck cars, car passers and special equipment.

95 MINE, SHAFT AND INCLINE HOISTS

Superior-Lidgerwood-Mundy Corporation—Bulletin M515 describes and illustrates a full range of steam, electric, gasoline and diesel powered hoisting, machinery, "engineered and designed to suit", yet consisting of standard parts. They are for use in mines, steel works, industrial plants and engineering and contracting projects. Also hoists for special purposes. Sixteen pages include 36 illustrations of important installations; data required for estimating on mine, shaft and incline hoists; general information on mine hoists and hoists for shafts and slopes.

96 MORTAR CEMENT

Universal Atlas Cement Company—A comprehensive 24-page booklet, "Build Better Masonry with Atlas Mortar Cement," has just been prepared. It points out the advantages of Atlas Mortar Cement, which provides a single cementing material that produces superior mortar characteristics and performance both in laying-up units and in finished masonry. There is also a section on recommended practice covering materials, proportioning, mixing and laying of units.

97 MOTOR GRADER

Galion Iron Works & Mfg. Co.—The 28-page catalog (395) on Model 118 motor grader gives detailed cross-sections of the grader and its parts. The brochure claims that this grader has the power for doing all types of heavy construction, oil mix and heavy maintenance jobs.

98 MOTOR SCRAPER

Allis-Chalmers Manufacturing Company—The TS-200 motor scrapers and TR-200 motor wagon, rubber-tired earthmoving units, are described in the two-color catalog in which components of the two units are also featured. The motor scraper has a 10-cu. yd struck and 13-cu. yd heaped capacity; the motor wagon 11-cu. yd struck and 15-cu. yd heaped, or 18 tons capacity.

99 MULTIPLE BASE ALTIMETRY

Wallace & Tiernan—Multiple base altimetry produces higher accuracy than "text book" methods and permits using surveying altimeters at times which were previously considered unsuitable from the standpoint of meteorological conditions. This new concept of altimeter surveying is described in a technical paper entitled, "Multiple Base Altimetry" which is available as reprint RA 2005-A.

100 OIL HYDRAULIC CONTROLS

Commercial Shearing and Stamping Company—Offers 20 pages of factual information on Commercial Fluid Power Controls, designated Catalog H-7. Performance data, capacities, types, details and mounting dimensions of oil hydraulic pumps, motors, valves and cylinders. Illustrations include photographs of typical installations, cut-away drawings and design sketches of all the controls needed for a complete heavy duty oil hydraulic circuit.

101 OIL STORAGE TANKS

Chicago Bridge & Iron Company—A four-page folder, "Oil Storage Tanks," describes Horton Flat-Bottom tanks for oil storage. A table of standard capacities and detailed information on size, weight and shell thickness is included. In addition, the folder contains a page illustrating welding details for flat-bottom storage tanks.

102 OPTICAL PLUMMET

Kern Instruments, Inc.—A brochure describing the use of this optical plummet at Hungry Horse Dam points out the advantages of this unique instrument. It was especially designed to specifications of U.S. Corps of Engineers for precision vertical alignment of structural members, turbine shafts, elevator shafts, mine shafts and construction layout on dams, buildings.

103 PANEL FORMS

Superior Concrete Accessories, Inc.—A profusely illustrated bulletin explains the form panel without a metal or wooden frame. The combination clamp is the only basic working part in this new panel form.

104 PAVING VIBRATORS

Gar-Bro Mfg. Co.—Bulletin No. 106 discusses full depth paving vibrators for low slump airport and highway paving. A second section is devoted to vibrating along the side form only and to full depth vibrating.

105 PENCIL SAMPLE KIT

American Pencil Company—FREE! New Venus Blueprint Pencil Sample Kit. See for yourself how new Venus Blueprint Pencils give you more brilliant, clear, non-smear markings on all blue or white prints and coarse papers. Specially formulated lead is the reason. Sharpens to a needle point, never powders or smudges; markings are opaque and insoluble, resist oil and grease. Electronically controlled color accuracy. Kit includes two new Venus Blueprint Pencils plus a Venus Drawing Pencil.

106 PILES

Raymond Concrete Pile Company—Standard and step-tapered piles are described in Catalog S-55 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation-cast-in-place, precast and prestressed concrete, composite, steel, pipe and wood piles; also caissons, underpinning. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

107 PILES

The Union Metal Mfg. Co.—Test load data, engineering tables and descriptive information are contained in Catalog No. 81 on Monotube piles. It also includes numerous photos showing a wide range of job applications throughout the country. The Monotube is a fluted, tubular steel pile, either fully tapered or combining tapered and uniform sections. It is driven directly with a standard crane, leads and hammer, without the use of driving core or mandrel. Advantages listed: light weight, easy handling, speedy driving, economical field extensibility, visual inspection after driving, high load-carrying capacity with consequent economy per ton of load carried.

108 PIPE AND COUPLINGS

Naylor Pipe Company—To provide engineers with concise data on large diameter light-weight pipe, fittings and couplings, designed for general use in the construction field, a new bulletin No. 507 is offered. It covers specifications on pipe from 4 in. to 30 in. in diameter, standard fittings and welding flanges and includes details on the one-piece wedge-lock coupling.

109 PIPE-CLEANING TOOLS

Flexible Sales Corporation—Showing the various tools which can be used to clean pipe is the job of this 12-page booklet. With industry, railroads, municipalities and oil companies particularly in

CATALOG DIGESTS

mind, the catalog (55-B) also suggests pressure line scraper procedure. The booklet is well-illustrated with on-the-job photographs and cross-sections of the several tools.

110 PIPE DETECTOR

Detectron Corporation—An operating manual for pipe detecting instruments has just been printed. Although it was written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make of pipe detector.

111 PLANT DESCRIBED

Flint Steel Corporation—Offers three, 12-page, two-color brochures describing the overall sales, engineering, detailing, estimating and fabrication facilities of the Tulsa and Memphis Plant. The three specialized divisions of the company are described separately, one in each book. They are galvanized towers and substations, structural and reinforcing, and plate and tank divisions.

112 PNEUMATIC GROUTER

Mayo Tunnel and Mine Equipment—Four-page Bulletin No. 13-c discusses grouting methods and uses. It also gives applications for the Mayo Grouter.

113 PNEUMATIC PIPE DRIVER

Atlantic Steel Company—A pneumatic pipe driver that derives its power from any standard paving breaker is described in a four-page pamphlet. The new tool consists of three parts: the driving point, the driving head and the driving shank. At speeds up to 25 ft per hour, the pneumatic pipe driver will drive pipe up to two in. in size.

114 POOL CONSTRUCTION AND EQUIPMENT

National Pool Equipment Co.—A discussion of several pool shapes and sizes is the subject of this colorful 16-page catalog. Filtration, chlorination, structural design are only a few of the topics considered.

115 POOL EQUIPMENT

National Pool Equipment Co.—Has a new 26-page catalog fully illustrating the most complete of highest quality pool supplies and equipment. It is also full of charts for the prospective pool owner, architect or engineer.

116 PORTABLE GASOLINE RAMMER

Barco Manufacturing Company—Offers an eight-page catalog describing the Barco Portable Gasoline Rammer for soil compaction. This tool is the only successful mechanical means of obtaining specified soil compaction in restricted areas such as in trenches and near walls and bridge abutments. It is easy to operate, safe, and will compact 20 to 30 cubic yards of fill per hour where high degree compaction is specified. Barco also offers a bulletin "Cost Data for Soil Compaction in Restricted Areas with the Barco Rammer" of interest to all earth moving contractors.

117 PORTABLE POWERED RIGS

Acker Drill Co., Inc.—Acker bulletin 28 describes both Acker Light duty RGT and Heavy duty RG portable powered soil sampling rigs. Acker SK drill heads are also described. This unit can be added to either the RGT or RG units for rock coring.

118 POWER PRODUCTS

International Harvester Co.—The complete line of International Industrial Power products, 73 in all, is described in a 48-page catalog. The first of the eight sections in the catalog describes the seven crawler tractors. In the other sections information is given on bulldozers, scrapers, attachments and power units.

CATALOG DIGESTS

119 PRECAST CONCRETE WALL PANELS

Portland Cement Association—A 16-page illustrated booklet discusses various types of precast concrete panels and shows their use in buildings where walls are attached to the structural frame. Line drawings illustrate details for different panel types including solid sections, sandwich, thin-wall and others. Sandwich panels have insulation between two layers of concrete. Inserts, joints and methods of attachment are also shown.

120 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—Complete specifications on the Berger "N" line of moderate-priced builders' instruments are included in an illustrated brochure now available. Companion line to the company's engineering, mining and astronomical instruments, the "N" line consists of a convertible transit-level, a 12 in. heavy-duty dumpy level, a service transit level (farm level) and a hand level.

121 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—"Solar Ephemeris and Polaris Tables," 1955 Edition, 96 pages, contains complete instructions for determining azimuths from the sun and the altitude of Polaris, prepared by Herman J. Shea, associate professor of surveying, Massachusetts Institute of Technology. Directions for making astronomical observations and computing results by direct solar observation and time from same observation: meridian by solar attachment; meridian by Polaris at elongation; azimuth by Polaris at any hour angle; latitude by sun at noon, and latitude by Polaris are included, as well as all requisite tables. Price is $.50 per copy.

N. B. *There is a charge for this book. Make checks payable to C. L. Berger & Sons, Inc.*

122 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—An informative 4-page brochure, combining a catalog and calculating chart, has been prepared. Pictured in four colors on the cover is the Berger Type R transit, one of the many instruments produced by the 84-year-old firm. On the center spread are photographs and code names for 12 types of Berger instruments, from an 18 in. dumpy level to a plane table alidade.

123 PRE-MIXED GROUT

The Master Builders Co.—Has published an 8-page illustrated folder describing the advantages of Non-Shrink Embeco Pre-Mixed Grout. It gives complete directions for using this product for grouting machinery, anchor bolts, building columns.

124 PRE-MIXED MORTAR

The Master Builders Co.—A 4-page illustrated folder describes the advantages of using Embeco Pre-Mixed Mortar. It gives complete directions for using this product for such work as patching concrete floors and steps; repairing wall seams and cracks; grouting around pipes through walls; caulking joints between floor slabs and basement walls; grouting steel sash and jambs.

125 PRESSURE FILTERS

The Permutit Company—Bulletin 2225B describes Permutit's extensive line of pressure filters and their accessories. These filters are being used to remove suspended solids such as dirt, turbidity, iron, oil and color from water supplies. Specifications, operating characteristics, outline dimensions and typical installation photographs have been included in this revised edition.

126 PREVENTATIVE MAINTENANCE

Flexible Sales Corporation—"Why Preventative Maintenance?" is a 48-page catalog (55-A) dealing with tools and methods to meet sewer maintenance and emergency problems. The maintenance equipment is accurately pictured and cleaning methods are suggested by actual photographs and drawings.

CATALOG DIGESTS

127 REBOILING DEAERATOR

The Permutit Company—Bulletin 3677 describes the advantages of the Reboiling Deaerator with direct contact internal vent condenser, which heats and deaerates water in three stages. This device operates equally well over a wide range of flows from 1% to 100% of rated capacity. It effects a thorough removal of residual non-condensible gases and reduces dissolved oxygen to less than 0.005 ml/1.

128 REFRACTORY FIBER

Johns-Manville—Has issued a 6-page folder on Thermoflex, a multi-purpose refractory-fiber felt for service to 2000 F. Originally developed as a jet engine insulation, Thermoflex now can serve as a filter medium for hot gases and liquids; as a sound control material; and as a refractory packing and fill. The folder presents essential data on Thermoflex including its K factor, sound absorption qualities, chemical and thermal stability, densities, sizes and thicknesses.

129 REINFORCED BRICK MASONRY

Structural Clay Products Institute—The first complete, authoritative handbook on the use of reinforced brick masonry in construction, entitled "Reinforced Brick Masonry and Lateral Force Design," fills a recognized need for technical information on lateral force design in masonry for architects and engineers. The principles of R B M design are the same as those nationally accepted for reinforced concrete but offer lower cost and more flexibility. The book reviews accepted design criteria, suggests methods of calculating stresses, and recommends reinforced brick masonry building code requirements. The price is $4.95.

N. B. There is a charge for this book. Make checks payable to Structural Clay Products Institute.

130 REPRODUCTION MATERIALS

Eastman Kodak Company—This brochure features the company's several reproduction papers and how they work. The list prices and sizes of the Kodagraph reproduction materials are included.

131 RING-TITE COUPLINGS

Johns-Manville—A 6-page illustrated folder shows how the Ring-Tite Coupling goes together, points out installation time savings, explains economies in service and cites typical uses in various parts of the United States. Data on sizes and weights is included, and the folder gives basic information on the Transite asbestos cement pipe with which the coupling is used.

132 ROAD ROLLERS

Essick Manufacturing Company—There are four folders presenting the several road rollers. Model 200 (1½ to 2 tons), Model 300 (2 to 3 tons), Model 400 (3 to 4 tons), Model 500 (3½ to 5 tons) and Model 800 (5 to 8 tons) are the units available and are described with specifications and photographs. Sealed ball bearings, worm gear steering assembly, air cooled engine, enclosed transmission are only a few of the features of this line of road rollers.

133 SCAFFOLDING

Universal Manufacturing Corp.—This scaffolding catalog provides clear-cut layout and engineering information of particular interest to masonry, construction and maintenance contractors. It shows how to economize by "single-bracing" scaffold runs; how bolting may be eliminated; and, generally, how to simplify scaffold problems.

134 SEWAGE EJECTORS

Chicago Pump Company—Offers engineering tables simplifying the selection of clog-proof "Flush Kleen" sewage ejectors. Examples are given for determining the inflow, discharge heads and type of "Fluch Kleen" sewage ejector to use in any of the following applications: underground municipal lift stations, industrial applications, building installations such as hotels, apartment buildings, bus terminals, railroad stations.

CATALOG DIGESTS

135 SEWAGE REGULATORS

Brown & Brown, Inc.—Bulletin 81 with supplements A and B describes sewage regulators designed to automatically control diverted sanitary flows from combined sewer systems, either by cutting off such flows entirely during storm periods, or by governing such diversions to a constant predetermined quantity regardless of storm conditions. Charts for the ready solution of diversion problems are included.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

136 SHORING COSTS

Universal Manufacturing Corp.—A money-saving technique in shoring concrete forms is described and illustrated in a 24-page engineering presentation. Based on contractors' experiences in shoring, it explains and illustrates each job application with photos and engineering layouts.

137 SLURRY PUMPS

Georgia Iron Works Co.—A discussion of the requirements, engineering and construction of the slurry pump is the subject of this well-illustrated catalog. These pumps are said to have improved suction qualities and greater stability.

138 SPEED MAPPER

V. & E. Manufacturing Co.—A sheet with price list explains the speed mapper, a machine for plotting transit data directly from field notes to the map.

139 SPONGE PUMP

Byron Jackson Co.—A 4-page bulletin describes the pneumatic sponge which is a centrifugal pump driven by a rotary air motor, designed for mining, construction and salvage service. A highly detailed cross-sectional drawing of the pump is given.

140 STABILIZED GRAVEL

Seaman Motors, Inc.—Bulletin No. 65 refers to the use of gravel in road or street work. It concerns construction and reconstruction of graveled roads and aims at conservation and economy in the use of gravel.

141 STANDARD PRODUCTS CATALOG

Link-Belt Company—A 340-page guide to one of the most complete standard lines of power transmission and conveying equipment is now available. This indexed book contains information for the engineer or layout man in selecting standard products for new installations or for replacements. It includes data on the line of chains for conveying and power transmission, ball and roller bearings, enclosed gear drives, clutches, gears, couplings.

142 STANDARD STEEL SHAPES

Commercial Shearing and Stamping Company—Has a 20-page booklet (P-3) on 18 Commercial Standard Shapes which are available without tool and die charges. Sketches illustrate each of these shapes in detail and tables show sizes, metal thickness and principle dimensions. For the first time, circular shapes are offered from dies in existence, covering a complete range of sizes from 4 in. to 72 in. in diameter.

143 STEEL FORMS

Economy Forms Corporation—Catalogs are available on form panels, accessories, tools and supplies. They illustrate the use of Lifetime Steel Forms for concrete construction on either the rental plan or the purchase basis.

CATALOG DIGESTS

144 STEEL JOISTS

Laclede Steel Company—The 1955 edition of the Straight Chord Steel Joist Catalog provides the most recent publication of standards for open web structural members for use in floor and roof construction in spans up to 50 ft. The joists considered are all standard products.

145 STEEL MEASURING TAPES

Keuffel & Esser Co.—Offers a new 4-page brochure illustrating and describing Albadure Steel Tapes and showing comparisons in wearing qualities and lasting legibility between Albadure and other types of steel tapes.

146 STEEL RIGID FRAMES MANUAL

Martin P. Korn—Part one presents the fundamentals of analysis and design, including selection of type of frame, derivation of basic equations, and tables of design for single span frames of from 50 to 150 ft. Part two of the volume is a collection of actual designs of a number of structures: an auditorium, bridges, and others. Martin P. Korn is the author. (J. W. Edwards, Inc., Ann Arbor, Mich., 1953. 170 pp., $4.50.)

N.B. There is a charge for this book. Make checks payable to J. W. Edwards, Inc.

147 STEEL SHEET PILING

Unites States Steel Corporation—An attractive, well-diagramed book describes steel sheet piling which is comprised of a series of rolled sections with interlocking joints. This 56-page, hard-bound book explains in detail the sections which are, generally, the Straight Web, Arch Web and Z Piles.

148 STEEL TUNNEL SUPPORTS

Commercial Shearing and Stamping Company—Offers a 28-page catalog concerning tunnel linings. Described are steel liner plates for water tunnels, sewer tunnels, railroad tunnels, service tunnels, highway tunnels, caissons, shafts, mine roofs and overcasts. On-the-spot photographs and informative tables help to tell the complete tunnel lining story.

149 STRUCTURAL ARC WELDING

The Lincoln Electric Company—A series of case histories in structural arc welding is issued periodically. Current series studies: the design of a continuous girder bridge without floor beams; a seven span bridge, 762 feet long and 86 feet wide; roadway supported on each side by five lines of girders on which rests the reinforced concrete slab. The study presents detailed drawings and explanatory notes.

150 SURVEYING ALTIMETERS

American Paulin System—Micro and Terra Altimeters, and the Micro Surveying Barograph are illustrated, and their specifications given in this new brochure. The necessary accessories are listed as well.

151 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A 16-page condensed catalog, "Accuracy in Action," illustrates the engineering and surveying instruments manufactured by the company. General characteristics, optical systems and accessories for the Berger line of engineers' transits, levels, mining transits, theodolites, collimators and alidades are fully described with essential specifications for each. A section devoted to builders' and contractors' instruments is also included.

152 SURVEYING INSTRUMENTS

Charles Bruning Company, Inc.—A two-color broadside, with illustrations and descriptions of the Brunson Instrument Company's complete line of patented, ball-bearing surveying instruments, has been issued recently. Also available is a 4-page folder featuring Brunson's Model 65, Builders Transit-Level.

CATALOG DIGESTS

153 SURVEYING INSTRUMENTS

Fennel Instrument Corporation of America—Offers a folder on their line of precision instruments. Photographs, detailed descriptions of the models, prices are included.

Return the coupon today!

154 SURVEYING INSTRUMENTS

David White Company—Bulletin #1054 shows the complete line of engineering instruments, transits, levels, alidades, wide frame tripods and other items of interest to the engineer, surveyor and large construction companies.

155 SURVEY MARKERS

Copperweld Steel Company—A four-page leaflet introduces survey markers which will locate survey points permanently. Each marker consists of a steel core to which a thick copper covering is molten-welded. The leaflet provides specifications and explanatory photographs.

156 TAMPERS

Wm. Bros Boiler & Mfg. Co.—This brochure (RE-140) covers tampers in medium, and giant weights. Single, double and triple drum models are listed. Standard Sheepfoot Tampers and Standard Diamondfoot Tampers with relief shank are shown, also the Tamprite Feet with replaceable Tamprite Tips.

157 TECHNICAL DATA CATALOG

Lefax—The newly revised Lefax Catalog of Pocket Size Technical Data Books is announced, covering every field of engineering. Partial listing includes: Surveying Theory and Practice, Surveying Tables, Building Construction, Reinforced Concrete, Highway Engineering, General Math, Math Tables, Physics, Trig-Log Tables. Books contain about 140 loose leaf pages of up-to-date material arranged for ready reference by engineers, construction workers, technical workers, students and teachers.

158 THEODOLITE

Geo-Optic Company, Inc.—Has a leaflet describing the optical universal theodolite Askania TKT Transit with terrestric telescope (erecting eyepiece). The Askania TKT Transit enables surveyors to cope with any possible problem of triangulation and to obtain results of the highest accuracy. All readings are done from one position—an important time factor. Other advantages and data are included.

159 TIDE GATES

Brown & Brown, Inc.—Bulletins 69 through 73, 75 and 76 describe various types of tidal gates, both circular and rectangular, and give authentic information regarding head losses.

160 TRACTOR SHOVELS

Clark Equipment Company—A well-diagramed catalog features two tractor shovels: the 1⅛ cubic yards Model 125-A and the 2¼ cubic yards Model 175-A. These two units, belonging to the "Michigan Line" of machines, offer four speeds, both forward and reverse.

161 TRANSIT

Wild Heerbrugg—A new piece of literature describes the reading principle of the new twenty second T-1 Repeating Transit. Model T-1 is now available as an alternative to the standard model (reading direct to one minute interpolations to six seconds) and gives direct reading to twenty seconds on both circles with easy interpolations to ten seconds.

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162 TRANSITS

W. & L. E. Gurley—The complete line of surveying, and engineering instruments, including transits, levels, alidades are described in the newly-revised edition of Catalog 50. The bulletin includes a cross-sectional drawing of the Gurley Precise Transit. Transits described include the Hell Gate Precise Transit; Standard Precise Transit; the Gurley Telescopic Solar Transit; the Standard Precise Mining Transit; and the Optoplane Precise Transit, for industrial use.

163 TRANSIT-LEVEL

Warren-Knight Co.—Has just published a brochure on the most recent transit-level. This instrument differs from a transit in that it has a horizontal limb vernier reading to one minute and, because of its unique design, it can be adjusted like a Wye Level. The pamphlet includes specifications.

164 TRANSIT-LEVELS

Bostrom-Brady Mfg. Co.—A specification chart on transit levels has been prepared which shows three different available levels. A farm level, a contractors' level and a convertible level are the instruments described and drawn on this sheet.

165 TUNNEL AND MINE EQUIPMENT

Mayo Tunnel and Mine Equipment—Illustrating installations of special equipment for tunnels and mines is for 4-page Bulletin No. 15. Included are telescopic tunnel and sewer forms, conduit forms, full-round telescopic forms, non-telescopic steel forms and others.

166 TUNNEL DRIVING

Eimco Corporation—The result of teamwork and know-how in high speed tunneling is described in a recent booklet (L 1005A). It includes facts and figures on famous tunnels and gives action photographs of the work.

167 TURBINES

James Leffel & Co.—Have issued Bulletin #1091-E, describing the Chatuge Dam Power Plant of the Tennessee Valley Authority; and #1089-E, illustrating 24 typical turbine designs.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

168 UNDERWATER SURVEY DEPTHOMETERS AND METAL LOCATORS

Bludworth Marine—The recent supersonic Survey Recorder, which makes underwater surveys faster and more accurate, is described in bulletins published by the company. It works well on channel dredging, salvage or coastal construction jobs. It reveals the character of bottom material while recording depth. The Underwater Metal Locator, also explained in recent literature, detects ferrous and non-magnetic metallic objects. Almost buoyant, it weighs only 1½ pounds submerged. It can be handled easily by professional and skin divers, and salvage operators.

169 UPWARD-ACTING DOORS

The Kinnear Manufacturing Co.—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 83, it gives information on installation clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

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170 VACUUM METHODS

Vacuum Concrete, Inc.—Has available for distribution a 16-page pamphlet describing the use of the Vacuum Methods in the construction of precast thin-shell roof and floor panels and precast concrete tilt-up walls. Also available are reprints of articles describing several projects located in various parts of the country.

171 VALVE CONTROLS

Philadelphia Gear Works—A complete 21-page catalog, L-54, describing "LimiTorque" valve operators has recently been published. LimiTorque eliminates the need for manual operation of valves and is favored for its simplicity, economy and dependability when fully automatic operation is desired. This catalog illustrates and describes the latest LimiTorque SMA valve control for large or small valves, as well as showing operational details and illustrations.

172 VALVES

Lunkenheimer Co.—A comprehensive, 506-page catalog, featuring a special 24-page Valve Selector Guide and over 100 pages of reference data, describes the Lunkenheimer line of steel, iron and bronze valves, and lubricating devices, boiler mountings, cocks and other products. The thumb-indexed Valve Selector Guide groups valves according to the pressure classifications.

173 VALVES

Martin Iron Works, Ltd.—Presents an informative pamphlet on its line of low cost valves and gate valves. Described are type X flap valve, hub end gate valve, and types L, W, XL, and LC gate valves. If you have a flow control problem, a Martin Gate Valve may supply the answer.

174 VIBRATORS

Viber Company—There are available reprints of case history ads and a pamphlet: "How to apply, operate, and maintain external vibrators in the manufacture of concrete pipe."

175 VIBRATING SCREENS

Link-Belt Company—A complete line of vibrating screens for medium and heavy duty screening operations is described in a 12-page book, No. 2554. Used for scalping, sizing, dewatering and rinsing, these screens can handle many types of materials such as coal, wood chips and gravel.

176 VIBRATORY COMPACTORS

Jackson Vibrators, Inc.-Electric Tamper & Equipment Co.—Shown and described in an equipment catalog are the following: multiple vibratory compactors for complete compaction of macadam base courses and sub-bases; manually guided vibratory compactor for achieving maximum density of granular soils in trenches, close to abutments, sub-bases, patching blacktop pavement, paving drives; internal and external vibratory paving tubes, sideform vibrators and vibratory screeds for better paving; 1.5 to 7.5 KVA portable power plants generating both single and 3-phase 120 V. 60 Cy. AC.

177 WALL-FORM CONSTRUCTION

Symons Clamp & Mfg. Co.—Offers a new catalog, F-10, on its system of wall-form construction. Latest information and improvement in the Symons Forming System are given. Illustrations show in detail: how simply and easily the forming system operates; actual construction where forms have been used; the forms are shown in use as in completed jobs, also contains detailed information on Safety Shores and Column Clamps. Symons Engineering Department prepares, free-of-charge, form layouts, bills of material and cost sheets for new jobs.

178 WATER FILTERS

Proportioneers, Inc.—Bulletin 1800-3 describes Purecel Diatomite Filters for use in filtration of water in municipal and industrial water works and

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in swimming pool recirculation systems. Engineering data on the application of these filters, including specifications and dimensions covering the complete recirculation and purification systems are given.

179 WATERPROOFING

Sika Chemical Corporation—A brochure describes quick-setting compounds and methods for use in sealing pressure leakage, through concrete and masonry in tunnels, tanks and deep basements.

180 WATER, SEWAGE AND WASTE TREATMENT

Hardinge Company, Inc.—Has published a new 20-page catolog on their line of equipment for water, sewage and industrial waste treatment, Bulletin 35-D. The catalog shows details of construction and specifications for Hardinge Circular Clarifiers, up to 200 ft diameter, and Hardinge Rectangular Clarifiers with crane type scraping mechanism. Equipment applications discussed in the catalog include municipal sewage and water treatment, industrial water treatment and liquid waste treatment.

181 WATERSTOPS

Water Seals, Inc.—Offers a colorful 8-page brochure illustrating a complete line of waterstops along with the particular job application of each. Polyvinyl waterstops are flexible enough to withstand extreme joint separation, yet are rigid enough to stand up to the battering effect of pouring concrete. The stops are unaffected by acid, alkalies, petroleum products, chemicals or adverse atmospheric conditions and will not rust, rot, check or crack.

182 WATER WELLS, PUMPS

Layne & Bowler, Inc.—The latest pictorially illustrated brochure on Layne's complete service in the water supply field is now available. Water wells, vertical turbine pumps, shutter screens, special pumps, irrigation wells and pumps, special drilling, acidizing water wells and service work are all discussed with a complete listing of all Layne literature.

183 WELLPOINT SYSTEM

Moretrench Corporation—A new, informative 76-page catalog, fully illustrated, describes the Moretrench Wellpoint System and its use in dewatering various types of construction projects. It includes useful technical data on the system.

184 WELLPOINT UNWATERING SYSTEM

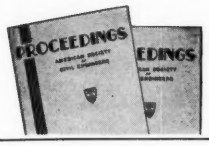
John W. Stang Corporation—A new 100-page revised edition of our catalog describes the component parts of the Stang wellpoint unwatering system; its planning, engineering and various methods of installation. Numerous recent projects have been added to demonstrate either a new application or some novel technical feature in the engineering and installation of the wellpoint equipment. Specific installations on dams, powerhouses, pipelines, tunnels, are illustrated from photographs made in the field. Heavy construction of all types in all varieties of soil conditions where ground water is encountered is described fully.

185 WOOD-TREATING

Monsanto Chemical Company—A question-and-answer booklet describes wood treatment with Penta (pentachlorophenol), a chemical which preserves the wood by penetrating deep into the wood cells to form a defense against decay and insects. The company claims that Penta will not leak out, evaporate or stain.

186 WROUGHT IRON

A. M. Byers Company—Presents a booklet which contains a brief review of highway installations in which wrought iron has been used. It suggests how and where this iron may be used to construction advantage.



PROCEEDINGS AVAILABLE

The following papers have become available as Proceedings-Separates. Following the date of issue of a paper, discussions thereof will be received for a period of three months, as specified on the cover of the paper. Titles will be added to this list every month, as they become available. Technical Division sponsorship is indicated by an abbreviation at the end of each item, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. Papers issued prior to, and including, Separate No. 289, were not distributed under the present automatic mailing system. If you have not registered in a Technical Division to receive its papers (one Division only) free of charge, please do so promptly by filling out and mailing the enrollment and subscription form (page 133) to Society Headquarters. For ordering separate papers, use the convenient order form on page 132.

March

634. Site Development for the E. F. Barrett Power Station, by William Welch, Jr. (PO) A review of the operating company's problems is followed by a discussion of the way in which a particular site was selected with a view to those features of a new site which are most desirable. The method of developing the selected site is described, and a general description is given of the plant arrangement.

635. Boysen Dam Diversion and Outlet Works, by R. W. Whinnerah. (PO) A novel feature of the 28-ft diversion tunnel at Boysen Dam is its location under the spillway crest to enable the spillway stilling basin to be used for diversion flows. The outlet works are unusual in that an old railroad tunnel is used for the outlet pipes and the stilling basin for two 48-in. outlet valves is in the powerhouse.

636. Design Features of Bear River Hydroelectric Project, by J. Barry Cooke. (PO) The development includes a 230-ft-high, concrete-face, rock-fill dam; a combination surge tank and creek diversion; an unlined tunnel; a 2,110-ft-head penstock; and a multiple-jet, vertical-shaft, impulse turbine. Basin design criteria and drawings of the various structures are presented.

637. Vibration in Hydroelectric Power Plants, by Samuel Judd. (PO) Vibrations which occur because of the forces of nature and those induced by moving or rotating equipment may cause loss of efficiency, objectionable noise, excessive wear, and fatigue failures and may result in a loss of property or revenue. The vibration sources and design criteria employed by the United States Bureau of Reclamation in the structural design of its hydroelectric power plants are discussed.

638. Waneta Hydroelectric Project, by Alfred F. Samuel, Jr., and Walter Emil Fisher. (PO) The problems arising in locating, designing, and constructing a run-of-river hydroelectric project are described. A review of a model study is included, as well as the description of a novel and successful method of sluice closure.

639. Engineering Advancements at McNary Project, by Louis E. Rydell and Glenn H. Von Gunten. (PO) The project, now being completed, is a principal unit in the comprehensive plan for developing Columbia River water resources. Engineering advancements included the highest single lift lock in the world, spillway and powerhouse structures, and hydroelectric power generating units; new developments on fish passage facilities; and unusual construction accomplishments. The paper discusses the project features and highlights the more significant engineering problems.

640. Life Expectancy of Steam Plant Equipment, by John J. Reilly. (PO) Engineers are often required to make estimates of life expectancy of modern steam-plant equipment. This paper describes the development and application to industrial property of various methods of statistical analysis and their use as an aid to judgment in connection with such estimates.

641. Discussion of Proceedings—Separates 517, 627. (PO)

642. Solving Pollution Problems through Cooperation, by J. M. Jarrett. (SA) Stream pollution abatement depends on how the engineer uses his own resources and the pure sciences such as biology, chemistry, bacteriology, and limnology; the social sciences; economical and political sciences; and legal science. It will also depend on the cooperation of experts in many fields. North Carolina has depended on the cooperative approach to stream pollution problems for many years. This approach is working extremely well, and more and more confidence is being generated among the various administrators.

643. Fission Products from Nuclear Reactors (A Quantitative Prospectus), by James G. Terrill, Jr., Dade W. Moeller, and Samuel C. Ingraham, II. (SA) The United States is on the threshold of practical electric-power production from atomic energy. It is estimated that some 90 million gallons of radioactive fission-product wastes will be produced daily in processing "spent" fuel from new power reactors built during 1964

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alone. The author presents tables and curves from which individual fission-product yields for thermal reactors of any power level, operated for different periods of time, can be predicted. The purpose of the paper is to give a concrete, numerical evaluation of the probable waste-handling problem of atomic-power reactors.

644. Hudson River Water—Its Characteristics and Treatment, by Richard Hazen. (SA) The quality of Hudson River water and the method of treatment used at several existing plants is discussed. A brief description of the geographical and hydrological features of the Hudson River drainage basin is presented along with summaries of stream surveys and quality data. Water plants which use the Hudson River as a source of raw water are described, and operating data are presented.

645. The Removal of Color from TNT Waste, by Gail P. Edwards and William T. Ingram. (SA) Research on the removal of color from TNT wastes was conducted at New York University College of Engineering in the Lewis Van Carpenter Sanitary Engineering Laboratory. Laboratory and field station results obtained with chlorination are discussed. Other less successful methods of treatment are mentioned. The efficiency of sellite waste color removal with chlorine is demonstrated.

646. Sanitary Engineering Aspects of Nuclear Energy: Progress Report of the Committee of the Sanitary Engineering Division on the Sanitary Engineering Aspects of Nuclear Energy. (SA) The report covers the Committee's activities for the year 1953–1954. The efficiency of conventional water- and sewage-treatment processes for the removal of radioactive waste materials, and the radioassay of liquid wastes is discussed. The Committee concludes that conventional processes are not effective for the removal of radioactive materials unless they are present in very low concentrations—below the microcurie per liter concentration range.

647. Discussion of Proceedings—Separates No. 454, 471, 472, 557. (SA)

648. Trussed Diaphragm in a Rigid Bent System, by Mortimer Margolin. (ST) There is presented an approximate method for determining the reactions of a series of parallel rigid bents connected at the roof by a continuous roof truss. The system analyzed is symmetrical in the longitudinal direction, and the construction is simplified for descriptive purposes.

649. The Constant Segment Method for the Analysis of Non-Uniform Structural Members, by Walter E. Hanson and Wallace F. Wiley. (ST) There are several general methods of analysis for beams having variable moments of inertia. Although precise, these methods are time-consuming in application and subject to numerical errors. Even the combination of column analogy and moment distribution sometimes becomes quite laborious. A method is presented which requires comparatively little computation, is simple in concept and use, and affords a high degree of accuracy.

650. Bolted Connections—Research, by W. H. Munse. (ST) The introduction of the high-strength bolt as a structural connector has made it possible to produce structural joints which are superior to and often more economical than comparable riveted joints. However, to obtain full benefit from the use of these bolts, it is necessary that they be installed with a high initial tension. The reasons for and the effects of this high tension are discussed herein on the basis of previous data as well as the results of static and fatigue tests which have been conducted recently on bolts and bolted connections subjected to shear and tensile loadings.

651. High Strength Steel Bolts in Structural Practice, by Mace H. Bell. (ST) Growth in acceptance and use of high-strength bolted connections in structural-steel construction has been rapid and widespread. The principal requirements for the assembly of such joints are discussed. Practical methods that have been developed to meet the requirements are described. Various applications in bridges and buildings are pictured.

652. Bending Interaction in Suspension Bridges, by Haaren A. Miklofsky. (ST) The paper describes a direct method of structural design by an interaction diagram as applied to the stiffening trusses of a suspension bridge. The developed diagram gives an over-all picture of the effect of changes in dimensions of the cross section of the stiffening truss on its stress and deflection. This diagram is drawn by analogy to a bending interaction diagram for a statically determinate structure. The Mount Hope Suspension Bridge is used as an illustrative example.

653. Shell versus Arch Action in Barrel Shells, by Mario G. Salvadori. (ST) A thin cylindrical shell hanging from two end arches and built into a foundation carries the loads partly as an arch and partly as a membrane. The relative importance of these two actions is evaluated for the case of a constant load. Maximum bending-moment and reaction values are determined as a function of the ratio of radius to length and of a thickness parameter.

654. Discussion of Proceedings—Separates No. 434, 468. (ST)

655. Job Opportunities in Sanitary Engineering, by Harvey F. Ludwig. (SA) The author discusses, primarily for the student of engineering, the nature of the sanitary engineering field and its current transition and expansion to meet the impact of new technology on our environment. Attention is given to the wide range of sanitary engineering employment in industry, government, and consulting, and to the "pros and cons" of the evolving sanitary engineering profession.

656. Discussion of Proceedings—Separates No. 385, 445, 475, 476. (SM)

657. Discussion of Proceedings—Separates 363, 476, 477, 499, 513, 516, 548, 550. (SM)

658. Discussion of Proceedings—Separates No. 215, 311, 513, 514, 516. (SM)